NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

OFFICE FOR COASTAL MANAGEMENT

Final Environmental Assessment Narragansett National Estuarine Research Reserve Boundary Change

Narragansett Bay, Rhode Island

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
Office for Coastal Management
1305 East West Hwy, N/OCM
Silver Spring, MD 20910
September 2021

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Acronyms

AQI	Air Quality Index
BCC	Birds of Conservation Concern
CAA	Clean Air Act
CELCP	Coastal and Estuarine Land Conservation Program
CZMA	Coastal Zone Management Act
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
HAPC	Habitat Areas of Particular Concern
MBTA	Migratory Bird Treaty Act
MMPA	Marine Mammal Protection Act
NAAQS	National Ambient Air Quality Standards
NBNERR	Narragansett Bay National Estuarine Research Reserve
NERR	National Estuarine Research Reserve
NERRS	National Estuarine Research Reserve System
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
OCM	Office for Coastal Management
PPT	Parts Per Thousand
RIDEM	Rhode Island Department of Environmental Management
RINHS	Rhode Island National History Survey
SWMP	System-wide Monitoring Program
USFWS	United States Fish and Wildlife Service

Chapter 1 Introduction and Background

The Narragansett Bay National Estuarine Research Reserve (Reserve or NBNERR) is a component of the National Estuarine Research Reserve System (System or NERRS), a federal-state partnership of protected research and education sites administered by the National Oceanic and Atmospheric Administration (NOAA), as authorized under Section 315 of the Coastal Zone Management Act (CZMA) (16 U.S.C. § 1461). Pursuant to 15 C.F.R. §§ 921.13, 921.33, the Narragansett Bay NERR has a NOAA-approved management plan that is to be updated every five years. The NOAA designated the NBNERR in 1980 in the City of Portsmouth, in Newport County, Rhode Island, to serve as a stable platform for long-term research and education of the nation's estuaries. Additional assistance is provided by local partners, including the Town of Portsmouth, RI (as the local jurisdiction), the Audubon Society of Rhode Island and the Prudence Conservancy. The Narragansett Bay Reserve is currently located on several islands situated within the geographic center of Narragansett Bay. The Reserve consists of nine separate property units located on Prudence, Patience and Hope islands. The Rhode Island Department of Environmental Management (RIDEM), which serves as the state's lead agency for the reserve, has requested to add lands to the Reserve boundary, which currently covers 4,229 acres. NOAA has reviewed the environmental and other consequences of the boundary change, as required by the National Environmental Policy Act (NEPA) regulations[1] (40 C.F.R. Parts 1500-1508) and the NERRS regulations (15 C.F.R. Part 921). This assessment summarizes the consequences of the Federal action, which is to approve the addition of 103 acres – the preferred alternative, as well as the alternative to take no action (leaving the boundary unchanged). The analysis evaluates the current and proposed future uses of the areas to be added, as well as the cumulative impact of these changes in combination with the existing boundary. The reserve is currently implementing the management plan approved by NOAA in 2015.

RIDEM maintains native fish, wildlife, plant species and natural communities for their intrinsic and ecological value and their benefits to people. This includes habitat protection, maintenance, and quality to ensure the survival of all species and natural communities. RIDEM is also responsible for managing diversified use of fish and wildlife including recreational, commercial, scientific, and educational uses. The Reserve operates a number of system-wide and Reserve-specific programs to carry out its objectives, including management-related research, estuarine education, coastal training, land stewardship (including habitat restoration), and volunteer programs. The Reserve protects, enhances, and restores habitat within its boundaries. It utilizes a science-based approach to land management and engages the public through volunteer and outreach events. In order to reduce pollution across the Narragansett Bay watershed, the Reserve improves understanding of pollution levels, sources, and effects on coastal habitats, generates and disseminates information on estuarine values, and undertakes management activities to decrease effects of agricultural run-off and erosion on the Reserve. The Reserve also is committed to monitoring the key indicators of ecosystem health in the watershed. The Reserve community collects, archives, and disseminates consistent, high caliber data on critical ecosystem characteristics. In order to educate the community about the watershed and inspire

[1] This EA is being prepared using the 1978 CEQ NEPA Regulations. NEPA reviews initiated prior to the effective date of the revised CEQ regulations may be conducted using the 1978 version of the regulations. The effective date of the 2020 CEQ NEPA Regulations was September 14, 2020. This review began on March 13, 2019 and the agency has decided to proceed under the 1978 regulations.

them to consider environmental conservation when making decisions affecting Narragansett Bay and its watershed, the Reserve creates and implements environmental education programs for school-aged children, visitors, and decision makers.

Figure 1.1: Map of Narragansett Bay Reserve in Rhode Island - Source: 2015 NB Management Plan

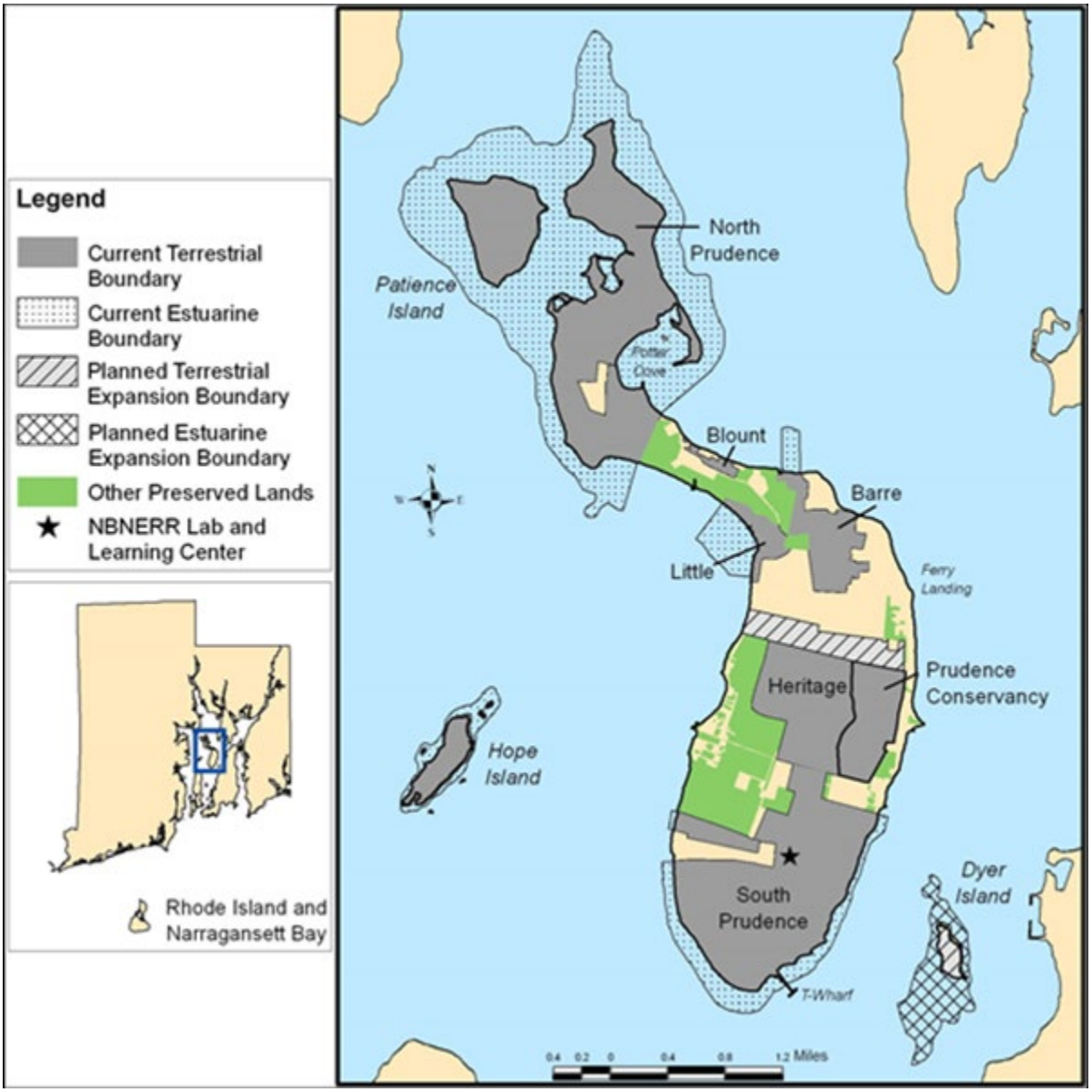

Figure 1.2: Map of Narragansett Bay National Estuarine Research Reserve

1.1 Background

National Context

The CZMA is the guiding legislation for the National Estuarine Research Reserve (16 U.S.C. § 1451 *et seq*.) This Act, administered by NOAA's Office for Coastal Management (OCM), provides for the management of the nation's coastal resources, including the Great Lakes. The goal is to "preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone." (16 U.S.C. § 1452). The CZMA outlines three national programs, the National Coastal Zone Management Program, the National Estuarine Research Reserve System, and the Coastal and Estuarine Land Conservation Program (CELCP). The National Coastal Zone

Management Program aims to balance competing land and water issues through state and territorial coastal management programs. The Reserves serve as field laboratories that provide a greater understanding of estuaries and how humans affect them. CELCP provides matching funds to state and local governments to purchase threatened coastal and estuarine lands or obtain conservation easements (OCM 2017).

The National Estuarine Research Reserve System (NERRS) is a network of 29 coastal sites designated to protect and study estuarine systems. An additional site is also being considered. Established through the CZMA, the Reserves represent a partnership program between NOAA and the coastal states. NOAA provides funding and national guidance, and a lead state agency or university manages each site with input from local partners. Figure 1.1 provides a map of the designated reserves.

The 29 Research Reserves cover over 1.3 million acres of estuaries and are focused on the following:

- Stewardship - Each site undertakes the initiatives needed to keep the estuary healthy.

- Research - Reserve-based research and monitoring data are used to aid conservation and management efforts on local and national levels.

- Training - Local and state officials are better equipped to introduce local data into the decision-making process as a result of reserve training efforts.

- Education - Thousands of children and adults are served through hands-on laboratory and field-based experiences. School curriculums are provided online.

The OCM encourages public awareness of coastal resources and best ways to address storm preparedness, erosion, development, habitat loss, sea level rise, public access, and threats to water quality, to name a few. As a scientific organization, NOAA provides access to the science and environmental intelligence communities need for these tasks.

Under 15 C.F.R. § 921.33, changes to the boundary of a Reserve and major changes to the final management plan, including state laws or regulations promulgated specifically for the Reserve, may be made only after written approval by NOAA. NOAA issued a public notice, including placing a notice of availability of the draft EA in the Federal Register on March 15, 2021, and provided an opportunity for public comment before approving the revised boundary. No public comments were received.

Reserve Context

The NBNERR was designated in 1980, becoming the 7th unit in the NERR System. At the time, the NBNERR was called the Narragansett Bay National Estuarine Sanctuary and was composed of only the North Prudence Island, Patience Island, and Hope Island units. Other units were incorporated into the Reserve as they were acquired in later years. Table 1.1 lists the parcels incorporated into the NERR. The RIDEM is the state lead agency for managing the reserve and owns most of the property within the reserve. Comprehensive resource protection and management for NBNERR is described in the site's management plan, first developed in 1983 and last updated in 2015. The management plan addresses programs for science, education, outreach, regulation, enforcement, permitting, and coordination with other local, state, and federal agencies. All areas in the NBNERR are designated as either a 'core' or 'buffer' area and permitted uses in each area are dependent on this designation. The NBNERR defines core areas as those "that are essential and representative of natural habitats in the biogeographic region in which the reserve is located. Recreation, habitat manipulation, and other disruptive uses are restricted in core areas"; likewise, buffer areas are defined as "those areas that are set aside to further protect core areas. Low-impact recreation, habitat manipulation, and research are permitted in buffer areas" (NBNERR Site Profile Ch.1-7). The entirety of the NBNERR is designated as a "core" area.

The NBNERR is now composed of 11 property units on four islands that are located roughly in the center of Narragansett Bay, R.I. (Figures 1.2 and 1.3) near the City of Portsmouth, in

Newport County. Seven units are located on Prudence Island, including the South Prudence and North Prudence units, which are the two largest units in the Reserve. The full extent of the three other smaller islands, Patience Island, Hope Island, and Dyer Island comprise the remaining three units (except for one private inholding remaining on Patience Island) (Table 1.1). The NBNERR also bounds all estuarine waters surrounding coastal units out to a depth of 18 feet (5.4 meters), except for waters adjacent to the Blount Unit on central Prudence Island (Figure 1.2). As of 2009 and the incorporation of the Ballard parcel, the NBNERR contained 2,542 acres of land and a total of 4,229 jurisdictional acres. (NBNERR Site Profile Ch.1-7 Page 13).

These protected areas provide habitat for a wide variety of fish and wildlife, including three federally listed birds, one mammal, five turtles, four fishes, two plants, and two beetles along with several mammals under the Marine Mammal Protection Act (MMPA), and migratory birds under the Migratory Bird Treaty Act (MBTA). Overall, 312 vascular plant species have been identified within the Reserve, including 232 native species and 80 exotic species (NBNERR Site Profile Ch.1-7, Page 39). While minimally studied, several species of moths, butterflies, beetles, and ticks have been identified (NBNERR Site Profile Ch.1-7, Page 57). Studies have identified 17 species of reptiles and amphibians on Prudence Island, and three species on Hope Island (NBNERR Site Profile Ch.1-7, Page 59). Birds identified throughout the NERR include maritime nesting birds, songbirds, and estuarine waterbirds (NBNERR Site Profile Ch.1-7, Pages 61-65). Finally, 15 species of mammals have been identified on Prudence Island; the number of mammal species present throughout the rest of the NERR is undetermined (NBNERR Site Profile Ch.1-7, Pages 69-70).

Table 1.1. List of parcels within, and proposed for inclusion, the current NBNERR boundary.

Parcel	Land acres	Submerged acres	Marsh acres	Beach acres	Wetland acres	Total acres	Year Acquired	Owner
Blount	18					18	1974	State of RI
Hope Island	70	68				138	1975	State of RI
North Prudence	717	900				1617	1978	State of RI
South Prudence	785					785	1980	State of RI
Patience Island	167	480	10			657	1980	State of RI
Barre	120	24	35			179	1988	State of RI
Little	52	51	33	6		142	1991	State of RI
Heritage	291				80	371	1992	State of RI
Prudence Conservancy	166					166	1992	Prudence Conservancy
Dyer Island	28					28	2002	State of RI
Ballard	128					128	2009	State of RI
Total	2,542	1,523	78	6	80	4,229		
Proposed Incorporation	*103*					*103*		*State of RI*

- Little Property								
Total with Little Property	*2,645*					*4,332*		

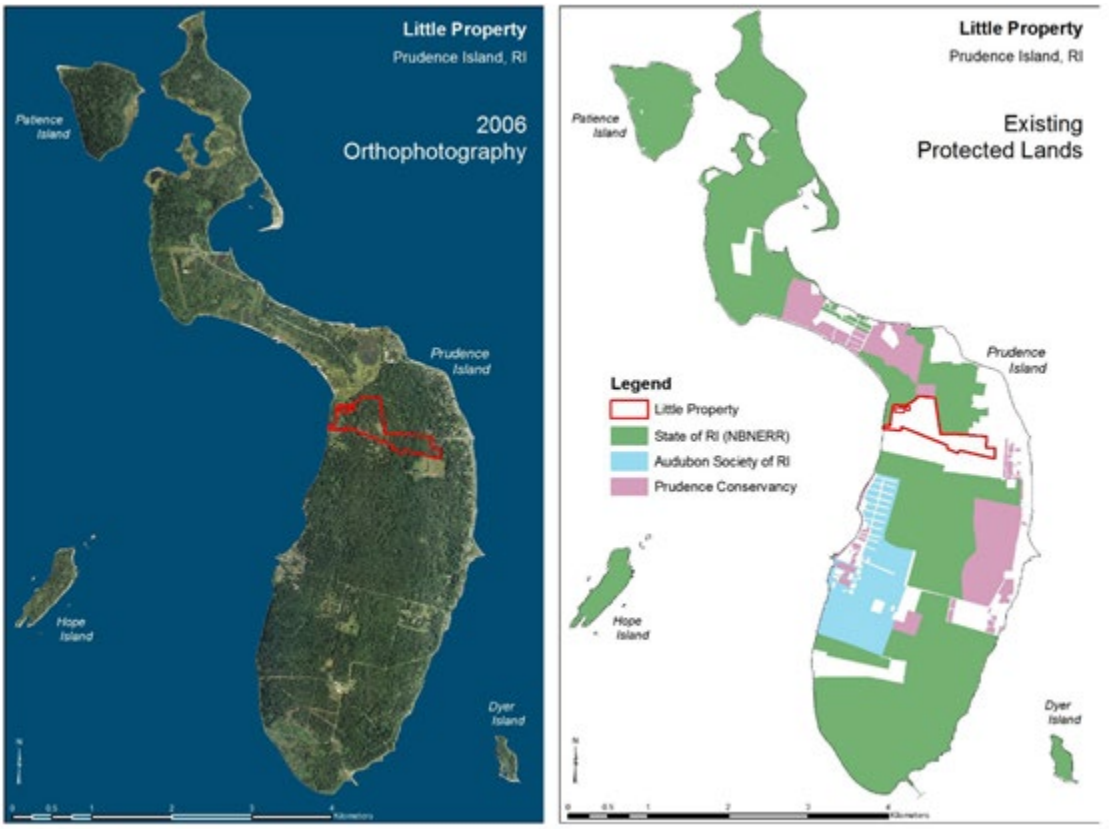

Figure 1.4: Location of Little property in reference to the NBNERR

1.2 Description of the Proposed Action

Under the proposed action, NOAA will approve the incorporation of the Little property (103 acres) into the existing management boundary of the NBNERR (15 C.F.R.§ 921.33). The Little property was acquired by RIDEM in 2015, with NOAA funding from the NERRS acquisition program, to protect it from development pressure. The Little property is located on Prudence Island, RI, the largest of the islands within the NBNERR, and situated in the geographic center of Narragansett Bay. The property runs primarily east-west from the western shore of Prudence Island across a high dry ridgeline, before it drops into the Mill Creek watershed and is bounded to the east by Sunset Hill Avenue. It is bounded along the northern border by another Reserve property as well as property owned by the Prudence Conservancy. The property is publicly accessible from both roads and trails for low impact recreational use such as birding, biking,

hiking, and hunting. The boundary change will extend the comprehensive conservation and management capacities identified in the NOAA-approved NBNERR management plan to new areas, providing a mechanism for implementation of specific restoration, monitoring and research activities for important marine resources.

1.3 Purpose of the Proposed Action

The proposed action will expand, as appropriate, the network of protected areas within the NBNERR (i.e., those areas in which existing Reserve regulations and management actions would apply). The purpose of the proposed action is to further the CZMA purposes and policies by implementing the NERR programs and plans on appropriate habitat parcels available for inclusion. The purpose of the proposed action also is to further the NERR mission to identify, protect, conserve, and enhance the natural and cultural resources, values, and qualities of NERR sites and its regional environment for this and future generations. Incorporating the additional parcel will provide continuity in science-based management of the Reserve's coastal resources that is compatible with its purpose to:

1. Increase opportunities for long-term scientific research and environmental education;
2. Provide a scientific research and monitoring program, which is responsive to the resource management needs of the cooperators for ultimate improvement of the management of this coastal ecosystem;
3. Enhance public awareness and understanding of the estuarine environment through the implementation of environmental education programs in the local public schools and the nearby communities, and by conducting on-site interpretation of the natural and cultural resources within the Reserve; and
4. Promote local, state, and federal government cooperation in the management of the Reserve.

The CZMA also states that changes in the boundary of a Reserve and major changes to the final management plan, including State laws or regulations promulgated specifically for the Reserve, may be made only after written approval by NOAA. NOAA may require public notice, including notice in the Federal Register and an opportunity for public comment before approving a boundary or management plan change. Changes in the boundary of a Reserve involving the acquisition of properties not listed in the management plan or Final EIS require public notice and the opportunity for comment; in certain cases, an environmental assessment and possibly an environmental impact statement may be required.

The proposed boundary expansion area fulfills each of the criteria for which the Secretary of Commerce may designated an area as a reserve, listed above.

1.4 Need for the Proposed Action

The goal of the NBNERR is to provide a natural laboratory for the study of estuarine ecological relationships. The proposed action will:

1. Formally incorporate a land parcel that would fill a gap on Prudence Island between existing reserve boundaries;

2. Allow the reserve to further its research and stewardship mission, and provide additional lands/uses for public use; and

3. Provide an opportunity for more coordination and integrated ecosystem management.

The proposed action -- incorporation of the additional land into the Reserve's boundaries – is necessary to address the following Reserve needs:

1. To provide ultimate management control within the Reserve, not only at present, but in years to come when land ownership and land uses may change to the point of altering the present natural resource values of the area;

2. To ensure a continuum of the baseline research without unregulated access;

3. To acquire lands suitable for interpretive and support facilities; and

4. As access sites to meet the goals and objectives of research/educational programs for the estuarine area.

The proposed boundary change will extend the comprehensive conservation and management capacities authorized by NOAA for the land in the existing NERR boundary, providing a mechanism for implementation of specific restoration, monitoring, and research activities for important estuarine resources. The incorporation of places of national significance into the NERR will support national ocean resource management objectives articulated by many publicly vetted and expert-driven strategic planning efforts under the administration of NOAA. At the same time, the opportunities for research, exploration, and education related to these significant ocean resources are critical for understanding changes occurring in the environment and the ecosystem services these resources provide for communities throughout this region.

The inclusion of the expansion land bordering the Reserve will contribute to the creation of a natural habitat corridor and a more complete unit for research and stewardship purposes. The inclusion will also protect those lands from pressure from land developers. The Little property also contains a few historical resources that will be preserved with its inclusion into the NBNERR.

1.5 Public and Agency Involvement

A Federal Register Notice was published on March 15, 2021 notifying the public of the boundary change proposal and its associated draft EA. Two email responses were received which confirmed they had reviewed the document but had no comments.

OCM contacted the US Fish & Wildlife Service on October 29, 2019, making a "may affect but not likely to adversely affect" determination; no response was received at that time. One additional comment was received from the USFWS during the public comment period. The Service offered technical corrections which have been made to the listed species list. Further, in

accordance with the Endangered Species Act, they confirmed that the acquisition of the Little property could offer wholly beneficial effects to the saltmarsh sparrow and offered the opportunity to work collaboratively in projects to support further conservation benefits for the species.

OCM contacted the Audubon Society of Rhode Island (ASRI) on October 24, 2019. ASRI responded on October 24, 2019, agreeing with OCM's determination of "no effect".

Additionally, OCM also sent letters on October 24, 2019, to the Mashpee Wampanoag Tribe, the Narragansett Tribe, the Wampanoag Tribe, the Prudence Island Historical & Preservation Society and the Rhode Island Historical Preservation & Heritage Commission. No comments were received.

Chapter 2 Alternatives

This chapter describes the two alternatives considered by NOAA. Alternative 1, leaving the boundary as is (No Action); and Alternative 2, expanding the NBNERR boundary to include the 103-acre Little property located near the center of Prudence Island (Preferred Alternative).

2.1 Alternative 1 (No Action)

Under the No Action alternative, NOAA would not approve the boundary expansion. Therefore, there would not be a change to the current boundary for NBNERR. The boundary would remain the same as approved in the NBNERR August 1980 FEIS and the NBNERR Management Plan published May 1983 and would maintain the Reserve's current size of 4,226-acres. The original biological, aesthetic, and socioeconomic needs to protect the natural resources would continue. Additionally, the management actions described above including education, research activities and protection would continue. However, these benefits would not be afforded to the proposed expansion parcels. Failure to designate and add the expansion parcels into the NBNERR boundary would not meet state and Federal goals for protecting, managing and studying estuarine ecosystems as a single integrated unit and would not meet the identified purpose and need.

2.2 Alternative 2 (Preferred)

Under the Preferred Alternative, NOAA would approve the incorporation of 103 acres to the existing NBNERR for a total of 2,645 land acres, and 4,332 total acres. The property was selected as expansion areas based on its ability to contribute to the NERR program through their biogeographical and ecological characteristics, value for scientific research and environmental education, and land acquisition and management considerations. The preferred alternative will further the mission of the NBNERR, which is to preserve, protect, and restore coastal and estuarine ecosystems of Narragansett Bay through long-term research, education, and training.

Under the Preferred Alternative, the Little Property would fill in a gap in the NERR near the center of Prudence Island. The expansion of the boundary will provide a more encompassing area for the Reserve's research, monitoring, and education programs. This expansion will

provide an opportunity for more coordination and integrated ecosystem management that would help the Reserve attain its mission of practicing and promoting coastal and estuarine stewardship through innovative research and education, using a system of protected areas (2015 Narragansett Bay Reserve Management Plan).

The Little property is ecologically and hydrologically part of the NBNERR, being located between the northern and southern components on Prudence Island. Unprotected lands on Prudence Island, like the Little property, face pressure from developers. Acquiring the Little property is consistent with Goal 1 of NBNERR's Management Plan, to "strengthen the protection and management of representative estuarine ecosystems within Narragansett Bay to advance estuarine conservation, research, and education." At the time of publication of the Management Plan, only 50 acres of this property was available for acquisition; the entire parcel is currently available. Acquiring this 103-acre parcel contributes to the development of a proposed natural corridor as outlined in the RI State Greenways Plan, as shown in Figure 2.1.

Figure 2.1. Diagram of the Little property as intersected by the Natural Greenway Corridor.

The Little property encompasses 103 acres of varying composition on Prudence Island. The property runs primarily east-west from the western shore of the island across a high dry ridgeline, before it drops into the Mill Creek watershed. It is bounded to the east by Sunset Hill Avenue, and along the northern border by another Reserve property as well and a property owned by the Prudence Conservancy. Historical resources present within the property include the Thomas Allin home site and the accepted site of Pulpit Rock, both at the northeast corner of the property. Additional historical features include a rifle pump, a wind-powered gristmill, and 16th-century stone walls throughout the property.

The elevation across Prudence Island ranges from 0 to about 185 feet (56 meters) above mean sea level. This variation leads to several habitats, such as forested wetlands at low elevations, mixed hardwood forests further inland, and coastal pine barrens at higher elevations. Habitats found throughout the Little parcel include brushland, idle agricultural lands, deciduous forest,

mixed deciduous forest, and wetlands. This property is potentially home to the Northern long-eared bat (*Myotis septentrionalis*), which was listed as threatened under the Endangered Species Act on April 2, 2015. Additional species of state concern found within the pine barrens include the margined tiger beetle (*Cicindela marginata*) and dark-bellied tiger beetle (*Cicindela tranqueberica*). It is likely that the locally-rare pine barrens are also home to other species of state concern, including various moths and birds.

Chapter 3 Affected Environment

Consistent with NEPA requirements, this chapter provides a narrative description of the physical, biological, and social/cultural resources affected by the alternatives presented in Chapter 2, including resources in both the current NBNERR boundary and the expanded NBNERR boundary. The information in this section, together with other information in this document, provides the basis for NOAA's evaluation of the potential environmental impacts of the expansion alternative as described in Chapter 4 (Environmental Consequences). The scope of the environmental impacts addressed in this EA includes those direct, indirect, and cumulative effects on the physical environmental (air quality and climate, geology and substrates, and water), the biological environment (living marine resources and protected species) and the cultural and human environment (cultural and historic resources and socioeconomics).

Narragansett Bay resides in a river valley and the reserve's islands are mostly thin glacial till and adjacent outwash. Soils can be classified as soil series, complexes, undifferentiated groups, or miscellaneous areas. Of the 27 possible soil types, Prudence island is mostly made of two soil series, Newport and Pequannock, as is the Little Property. These soils are well suited for farming and potential development but at risk of erosion. By designating this parcel as part of the reserve, there is no threat to use of this land and the eventual degradation of the current soil makeup.

The NBNERR encompasses habitats for a wide assortment of wildlife species. Invertebrates, reptiles and amphibians, maritime nesting birds, songbirds, and mammalian species can be found throughout the currently designated NERR, and on the proposed expansion parcel. One objective of NBNERR is to enhance habitat quality to ensure the survival of all species and natural communities. The Reserve operates a number of programs to carry out this objective, including habitat restoration, management-related research, estuarine education, coastal training, land stewardship, invasive species containment, and volunteer programs. For example, to decrease habitat degradation caused by pollution, the Reserve monitors pollution levels, sources, and effects on coastal habitats, and undertakes management activities to decrease effects of agricultural run-off and erosion on the Reserve. These measures allow the Reserve to protect, enhance, and restore Reserve habitats within its boundaries.

3.1 Physical Environment

3.1.1 Air Quality

The Clean Air Act (CAA) of 1970 requires states to adopt air quality standards. The standards were established to protect the public from potentially harmful amounts of pollutants. The US

Environmental Protection Agency (EPA) has established primary and secondary air quality standards. EPA has set National Ambient Air Quality Standards (NAAQS) for the following six criteria pollutants: ozone (O_3), nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), lead (Pb) and particulate matter (PM-2.5, PM-10).

In general, the air quality in Narragansett Bay is "good," meaning the air quality index (AQI) is between 0 and 50. AQI is measured on a scale of 0 to 500, and addresses pollutants including ozone and particulate matter (PM-2.5). RIDEM operates six air quality (AQ) monitoring stations throughout the state. Stations in the vicinity of Narragansett Bay show that O_3 and PM-2.5 levels are overall good, with ozone levels occasionally reaching "moderate" (51 to 100). Clear skies lead to higher ozone levels, which decreases air quality (AirNow, RIDEM).

Rhode Island has occasional days during spring and summer months when ozone concentrations exceed the 2015 Federal Standard and reach unhealthy (101-150) AQI. The past 2 decades show a trend of improvement in ozone concentrations. Rhode Island's ozone problem can be attributed to more polluted upwind regions. Rhode Island rarely exceeds the daily PM 2.5 Standard, but there are some days each year where fine particles reach the moderate stage of AQI. Increased concentrations of fine particles, smaller ultra-fine particles (UFP), and Air Toxics levels have been linked to locations alongside major highways. Fine particle concentrations have also trended downward due, in part, to improved vehicle fuel efficiency, lower vehicle emissions, decreases in the manufacturing sectors, and pollution mitigations programs (RIDEM Air Monitoring).

Carbon monoxide levels are measured at two of the six stations, and have not exceeded NAAQS standards since 2001. CO levels are identified as "good." SO_2 levels are measured at one AQ station, and have never exceeded the NAAQS level. All measurements have been "good" since 2007. NO_2 levels are measured at four stations, and have never exceeded the NAAQS level. 1-hour averages have exceeded the standard, but annual averages still fall within the "good" range. PM-10 levels are monitored at three stations, and have never exceeded the NAAQS level, thus presenting as "good" as well (RIDEM).

Development in the area, as well as significant military activity, contributes to air pollution. The majority of Narragansett's air pollution is brought from emissions from transportation, industrial emissions from nearby power plants, and pollution transfer from the New York City metropolitan area blowing in from the southwest. Both ozone and particle pollution are dangerous to public health and can increase the risk of serious health effects such as lung cancer, asthma, cardiovascular damage, and developmental and reproductive harm.[2] However, low pollution from undeveloped protected areas and sea breezes dispersing existing pollution lead to good air quality in the region.

[2] http://www.dem.ri.gov/programs/air/ozone.php

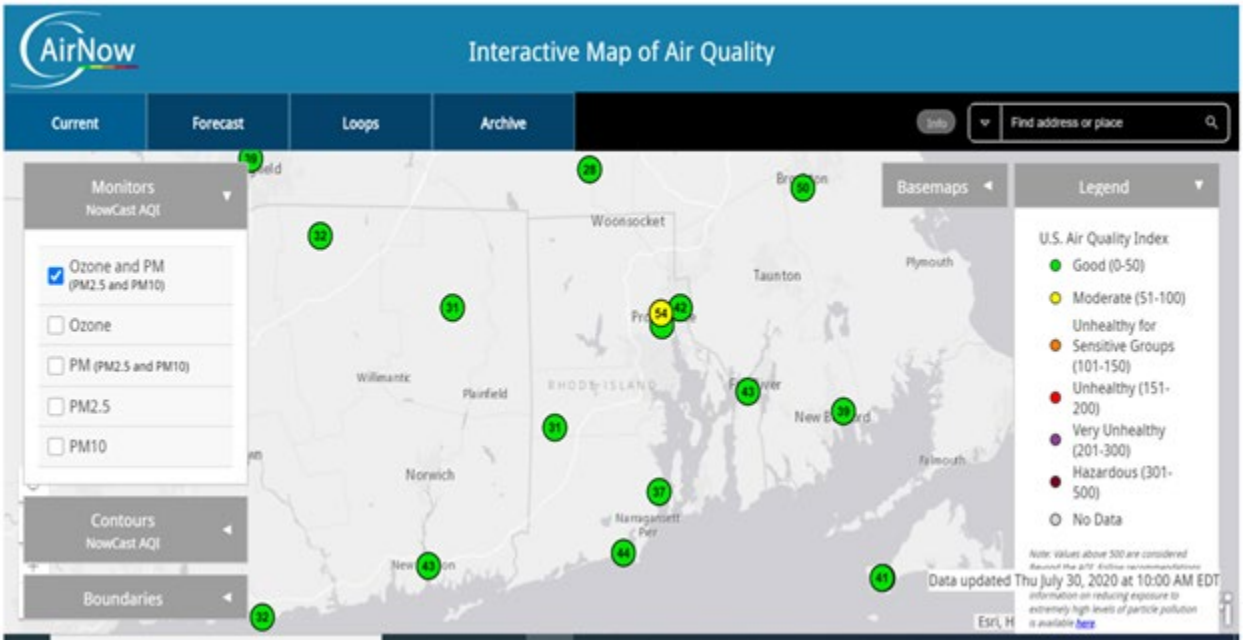

Figure 3.1: Snapshot of local air quality around NBNERR, accessed 19 September 2020 (https://gispub.epa.gov/airnow/).

3.1.2 Greenhouse Gas Emissions and Effects of Climate Change

NBNERR has a temperate, maritime climate, and is tempered by the surrounding Bay. Data collected from the NBNERR weather station (Campbell weather station located near Potter Cove on Prudence Island) indicates that air temperature, relative humidity, and the amount of photosynthetically active radiation (PAR) peak during the summer months (Site Profile, Pg. 25). Using data collected from the NOAA weather monitoring station at Potters Cove in 2012, the mean temperature of the area ranges from around 30-32 degrees in January and February to around 72-75 degrees in July (NOAA Potter's Cove Temperature Graphs). Air temperature increased approximately 1.5°C (2.7°F) from 1960 to 2015, while the increase in Bay water temperature was slightly greater at 1.6°C (2.9°F). Climate projections suggest that air temperature in the region will increase another 2 to 6°C (5 to 10°F) by 2100 (http://nbep.org/State of the Bay).

According to RIDEM, the region's climate can be summarized as such: equitable distribution of precipitation among the four seasons; large ranges of temperature both daily and annually; great differences in the same season of different years; and considerable diversity of the weather over short time periods. Rhode Island lies within the "prevailing westerlies," a belt of generally eastward movement circling the mid-latitudes. Air temperature, relative humidity, and the amount of photosynthetically active radiation (PAR) peak during summer months.

The expansion parcel is primarily on the interior of Prudence Island. However, the Narragansett Bay Watershed is susceptible to the increased precipitation and rising temperatures associated with climate change. Air temperature is anticipated to increase which will result in warmer fresh and estuarine water temperatures. Increases in precipitation and changes in precipitation patterns will result. In the Narragansett Bay Watershed, projected increases in precipitation are one to

three inches per decade, along with an increase in storm frequency and intensity. Tropical storms (e.g., hurricanes) are projected to be more intense.

In addition to its effects as a greenhouse gas, carbon dioxide is also causing changes to ocean chemistry in ways that are likely to affect the Narragansett Bay ecosystem. River discharge rates and composition will change leading to acidifying effects such as organic loading, eutrophication, and absorption of atmospheric carbon dioxide. Climate change will also alter the species composition, structure, and function of Narragansett Bay Watershed ecosystems, coastal and inland flooding will intensify, and sectors of the regional economy will be impacted (e.g., fisheries, agriculture, tourism), among other projected changes to the environment and society (http://nbep.org/Climate-Change-Stressor-Indicators)

3.1.3 Water Resources and Quality

Narragansett Bay is a partially mixed estuary, covering 174 square miles, with a drainage basin of 1,849 square miles in Rhode Island and Massachusetts. The Bay consists of a series of drowned river valleys, and contains 240 miles of shoreline. The average depth of the Bay's East Passage is 49.9 feet, and 24.6 feet in the West Passage. Fresh water flows into the Bay at an average 36 cubic meters per second. Bay sediments are primarily silts or clays in the Upper Bay, and fine sands toward the mouth. Salinities range from 22 parts per thousand (ppt) in the upper reaches, and 32 ppt near the mouth (FEIS).

The Little property is already hydrologically connected to the NBNERR. The Little property encompasses part of the Mill Creek watershed and designation of these lands will assist in the protection of the Nag Creek marsh system. The property also borders the watershed for the Prudence Island water supply, which is drawn primarily from the Indian Spring well on the Barre unit of the Reserve.

Ground Water

Ten types of wetlands are present throughout the four islands of the NERR: estuarine emergent wetland, estuarine rocky shore, estuarine unconsolidated shore, forested wetland-coniferous, forested wetland-dead, forested wetland-deciduous, freshwater marsh/wet meadow, palustrine open water, scrub-shrub swamp, scrub-shrub fen/bog. Almost 70% of the wetlands across the four islands are protected within the NERR boundary (Site Profile, pg 33). See Figures 3.2 and 3.3 for the location of wetlands within and around NBNERR.

Surface Water

Surficial bodies of water are not common throughout the NERR. A few small year-round ponds exist on Prudence Island, likely the number is around six. Additionally, there are around 9.7 miles of streams across Prudence Island, and an unquantified number of vernal pools. There are no standing freshwater ponds or streams on Patience or Dyer Islands. Two streams cross Dyer Island, along with two small freshwater ponds (NBNERR Site Profile). See Figures 3.2 and 3.3 for the location of surficial water bodies within and around NBNERR.

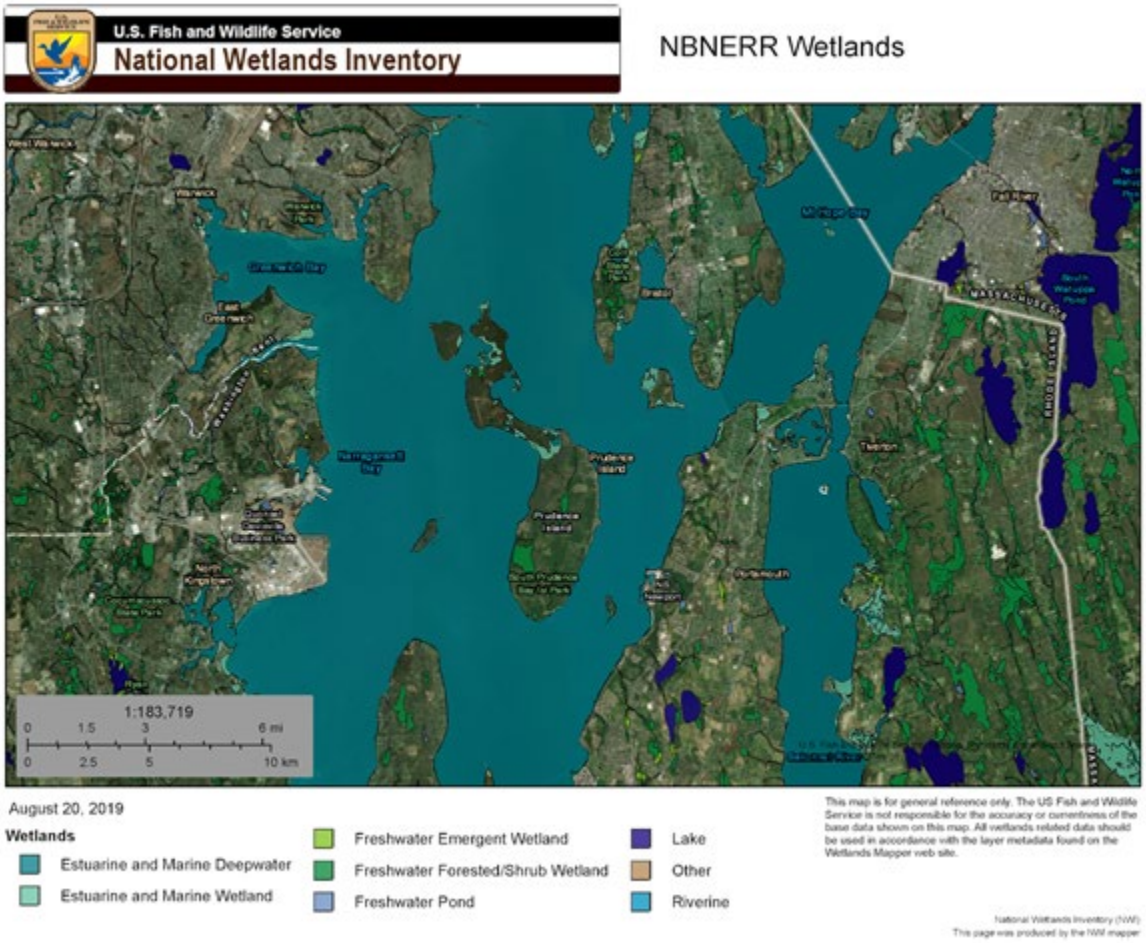

Figure 3.2: National Wetlands Inventory map showing NBNERR and the surrounding area

Figure 3.3: National Wetlands Inventory map showing a closer view of the Little property

The water quality of Narragansett Bay is generally “excellent”, with 92% of the Bay classified as SA (the highest rating) or SB (the second-highest rating). The Upper Bay is where most of the pollution ends up. The waters are polluted by inadequately treated sewage from Providence, as well as combined sewer overflows from Providence, Pawtucket, and Central Falls during storms. Waters from the Providence River down to Gaspee Point are classified as SC, while waters south of Gaspee Point are classified as SB (NBNERR Designation FEIS).

Estuarine/Marine Habitats of Narragansett Bay and around NBNERR (Site Profile Pgs. 91-101)

Pelagic Habitat:

The open water, or pelagic, habitat is the dominant habitat in Narragansett Bay, based on area. The Bay itself is phytoplankton-based with relatively little salt marsh or macroalgae. A wide variety of plankton, benthic communities, and nekton are found in and under the open water habitat of Narragansett Bay. This pelagic habitat provides food for many different birds, marine mammals and occasionally sea turtles. The pelagic habitat also supports several commercial and recreational fisheries and shellfisheries.

Benthic Habitat:

Occurring below the low-tide line, the subtidal, benthic (bottom) habitat of Narragansett Bay is composed of soft, unvegetated sediments, predominantly clayey silt, and sand-silt-clay. This habitat is found in the mid to upper Bay and in protected coves and embayment. Coarser, sandy sediments are found in the lower Bay. Sub-tidal waters support a diverse benthic community of mollusks, crabs, and worms that live in and on the sediments. There are 13 benthic habitat types found in the waters of Narragansett Bay. In areas of deep water in the mid-Bay, where sediments are soft and salinities high, a deposit feeding community flourishes on soft bottom and at the bottom of dredged channels.

Rocky Reefs:

Narragansett Bay has few natural rocky reefs (e.g., off Hope Island), but the West Passage of Narragansett Bay near Dutch Island is home to six small artificial rocky reefs. Constructed by NOAA Fisheries—made of two different sizes of quarried cobble—were built to enhance lobster stocks in the Bay. The addition of artificial reefs (habitat enhancement) in the past has led to an increase in the numbers of lobsters in Dutch Harbor through increased settlement and migration.

Submerged Aquatic Vegetation:

Eelgrass is a rooted, submerged flowering plant typically found in coastal and marine habitats. Eelgrass contributes to the health and productivity of these habitats. It plays an important role in the life cycles of scallops, crabs, finfish, geese, and ducks. The dense meadows of eelgrass provide breeding and nursery areas for young finfish and shellfish as well as a substratum for attachment in the water column and protection from predators. Many invertebrates also consume the decaying eelgrass and then become food for larger life forms, such as fish and crabs. High levels of nutrients entering a system from developed areas are taken up by eelgrass rather than being passed downstream where they might add to the level of pollution in a system. The current distribution of eelgrass in Narragansett Bay is patchy. Today, only two healthy beds exist within the boundary of the NBNERR.

In shallow areas, macroalgae may contribute to primary production particularly via contributions to detrital food chains. They provide habitat for a variety of organisms, such as bay scallop. Macroalgal proliferation can also cause degradation in an ecosystem. Eutrophication is when increased nutrients, especially nitrogen and phosphorus, come into an embayment from human sources causing overstimulation of plant growth. Large amounts of seaweed may clog beaches and boating areas and cause odor problems when they decompose. This also leads to oxygen in the water being depleted.

Salt Marshes:

Estuarine emergent wetlands, or salt marshes, are some of the most ecologically valuable habitats in the Bay. Salt marshes protect coastal areas from erosion, remove nutrients from over enriched waters, provide sheltered habitat and food for key resource species, and serve as nursery grounds for fish and shellfish. Animals such as shrimp, snails, clams, worms, and killifish consume plant breakdown products, graze on microscopic organisms growing on the surface of the detritus or scour epibenthic algae off the sediments. Salt marshes are characterized by two

general vegetative zones based on differences in tidal flooding—regularly flooded low marsh and irregularly flooded high marsh. The high marsh has a high diversity of species compared to low marsh zones.

Brackish Habitat:

Portions of Narragansett Bay where salinity levels are reduced by freshwater dilution are important for supporting important resource species such as oyster, soft-shell clam, and blue crab. However, the value of these brackish habitats can be compromised by their location at river mouths and within coves that are often subjected to intense physical disturbance from dredging and filling, and which serve as sinks for local and watershed contaminants. Brackish areas in Narragansett Bay tend to be small since many streams enter the water from steeply sloping shores or over dams. All brackish areas studied in Narragansett Bay supported species adapted to shallow water with low and variable salinity, extremes in temperature, and high concentrations of organic detritus. These include mollusks and polychaetas.

Intertidal (Littoral) Zone:

The intertidal zone is the area above the low-water mark and below the high-tide line. Narragansett Bay is composed largely of narrow cobble beaches. Within the NBNERR, beaches (some sand, mostly cobble) are found on Prudence, Patience, Hope, and Dyer islands; mud or sand flats can be seen in the North Prudence Unit; and rocky intertidal areas are found on Hope Island and at the southern end of Prudence Island. Organisms have to deal with extreme conditions such as changes in temperature or salinity, desiccation, and wave action. The predominant organisms in this subzone are barnacles, small gastropods, isopods, mussels, sea stars, and whelks. The upper littoral can also contain rock pools inhabited by small fish. In contrast, the “lower littoral” subzone is mostly submerged, only becoming exposed during low tides. This subzone has much more marine vegetation, especially seaweeds, or macroalgae. Organisms in this subzone generally are not well adapted to periods of dryness and temperature extremes. Organisms in this area include anemones, crabs, green algae, hydroids, isopods, mussels, nudibranchs, sculpins, sea cucumber, sea lettuce, sea stars, sea urchins, shrimp, snails, sponges, tube worms, and whelks.

3.1.4 Geology and Substrates

Narragansett Bay is a drowned river valley that remains open to the sea, and was the result of the most recent glaciation of New England. Sea level was lowered so much that the continental shelf was exposed, under its weight of ice, and the glacier carved into the Atlantic. Glaciers flowing through a geologically old sedimentary basin carved channels through the younger sediments and exposed much older bedrock. As the ice stalled, then retreated, the region became ice-free by about 14,000 B.C. A complicated sequence of marine ingression and isostatic rebound flooded and emptied the landscape. A fresh water proglacial lake called by geologists Lake Narragansett formed about 15,500 B.C. impounded behind terminal moraines: the lake lasted about 500 years, leaving the powerful flow of a post-glacial river running down its north-south axis. Then salt water filled the valley, as rising sea levels permanently flooded the area (Source - Save the Bay). The NBNERR islands are composed of thin glacial till with smaller areas of adjacent outwash.

The bedrock of Prudence, Patience, Hope, and Dyer islands is composed of stratified sedimentary rock from the Pennsylvanian age.

Soils

Based on a 1981 soil survey, soils can be classified as soil series, complexes, undifferentiated groups, or miscellaneous areas. A soil series characterizes soils by their profiles. Each series can be further broken into different phases based on characteristics such as slope, wetness, or salinity, among others. A soil complex is an area of at least two soils that are well mixed together or too small to be differentiated on a map. An undifferentiated group is also an area of two or more soils that are not separated simply because there is little value in doing so. By using this method of soil analysis, 27 different soil types (including multiple phases of the same soil series) are found on the four NBNERR islands. Based on acreage, the dominant soil types for each island (after summing multiple phases of the same soil series) are the Newport series (Prudence and Patience islands), the Canton and Charlton complex (Hope), and the Merrimac series (Dyer). Prudence Island mostly consists of non-hydric soils with roughly one quarter of the soils being hydric in the form of wetlands. Prudence island is mostly made of two soil series, Newport and Poquonock. The Little property follows this pattern and consists mostly of Newport and Poquonock soil classes. Poquonock soils can support (globally rare) pine barrens of which two are found on Prudence Island—one in the southwest corner of the island and the other directly south of Prudence neck.

Newport soils are more suited for woodlands and open land. Some areas can be wooded and common trees found there are northern red and white oak, gray birch, red maple, sugar maple, and eastern white pine. This soil is also suitable for community development but has issues due to permeability of the soil so onsite sewage disposal systems need special design and installation. Roads and streets are also at risk of frost heaving. Newport soils are suited for cultivating crops. Usually these soils will be utilized for farming uses like cultivated crops, hay, pasture, and nursery stock. Poquonock soil areas are used for community development. These soils can exist as open or wooded when untouched and are more prone to droughts. Common trees are northern red, white, and black oak, hickory, gray birch, aspen, white ash, and eastern white pine. This soil is good for farming and is typically used for cultivated crops, tobacco, vegetables, nursery stock, hay or pasture. The hazard of erosion is moderate and irrigation is needed during the summer where seedlings have a high chance of dying.

The soils found on Patience Island are much drier than Prudence, only about 12 percent of the soils are hydric and come from the brackish marsh found on the southeast side of the island. Hope Island is virtually all non-hydric soils despite the presence of two small wetlands. Hope Island mostly consisted of rocky outcrops and a high percentage of stones and boulders visible on the ground's surface. Dyer Island is mostly non-hydric soils (approx. eight percent). The portion of hydric soils comes from the small salt marsh on the southern end of the island (NBNERR Site Profile Pg. 29-32). Figure 3.4 shows the location of soil types throughout NBNERR.

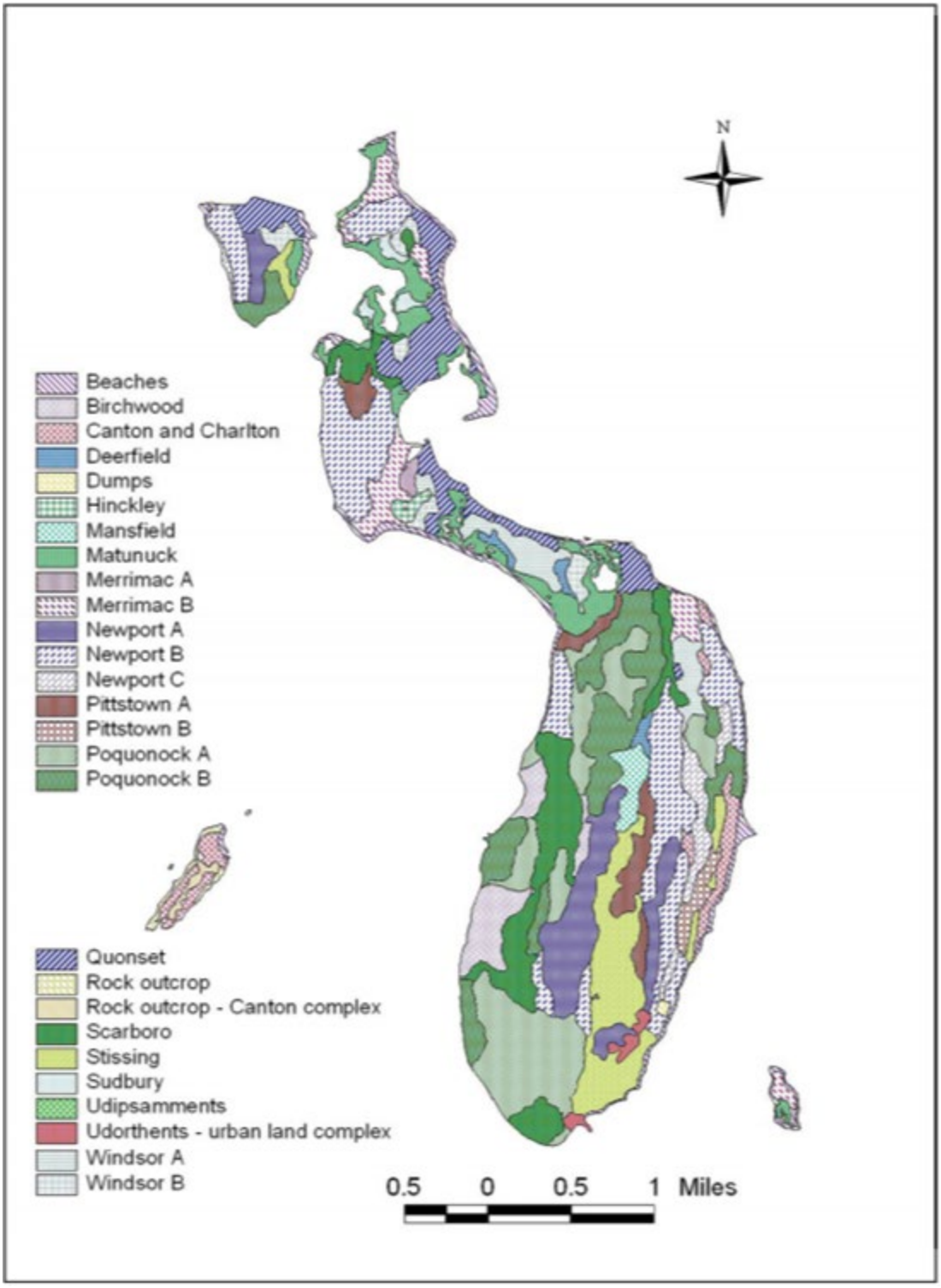

Figure 3.4: Map of the soil types within the NBNERR boundary

3.1.5 Habitats

The islands of NBNERR contain a high degree of variability in land cover and habitat types. Based on 1995 GIS data there are 23 land cover classes found on the four NBNERR islands. All 23 of the classes are present on Prudence, but not on Patience (seven land cover classes), Hope (three classes), or Dyer (three classes). Prudence Island's most abundant habitat type are secondary growth habitats. The majority of land cover on Prudence Island is deciduous forest (34 percent of the island), wetlands (21 percent) or brushland (19 percent). The land cover area of the NBNERR portion of Prudence Island was deciduous forest (32 percent), brushland (23 percent), and wetlands (21 percent). Of the natural land cover classes, at least 64 percent of the total acreage on Prudence Island was located inside Reserve boundaries. Evergreen forests, however, had only 20 percent of its class type located within the reserve. Land cover types and locations are shown in Figure 3.5. Table 4.2 in the NBNERR Site Profile details the exact acreage of each land type on each of the islands (Site Profile).

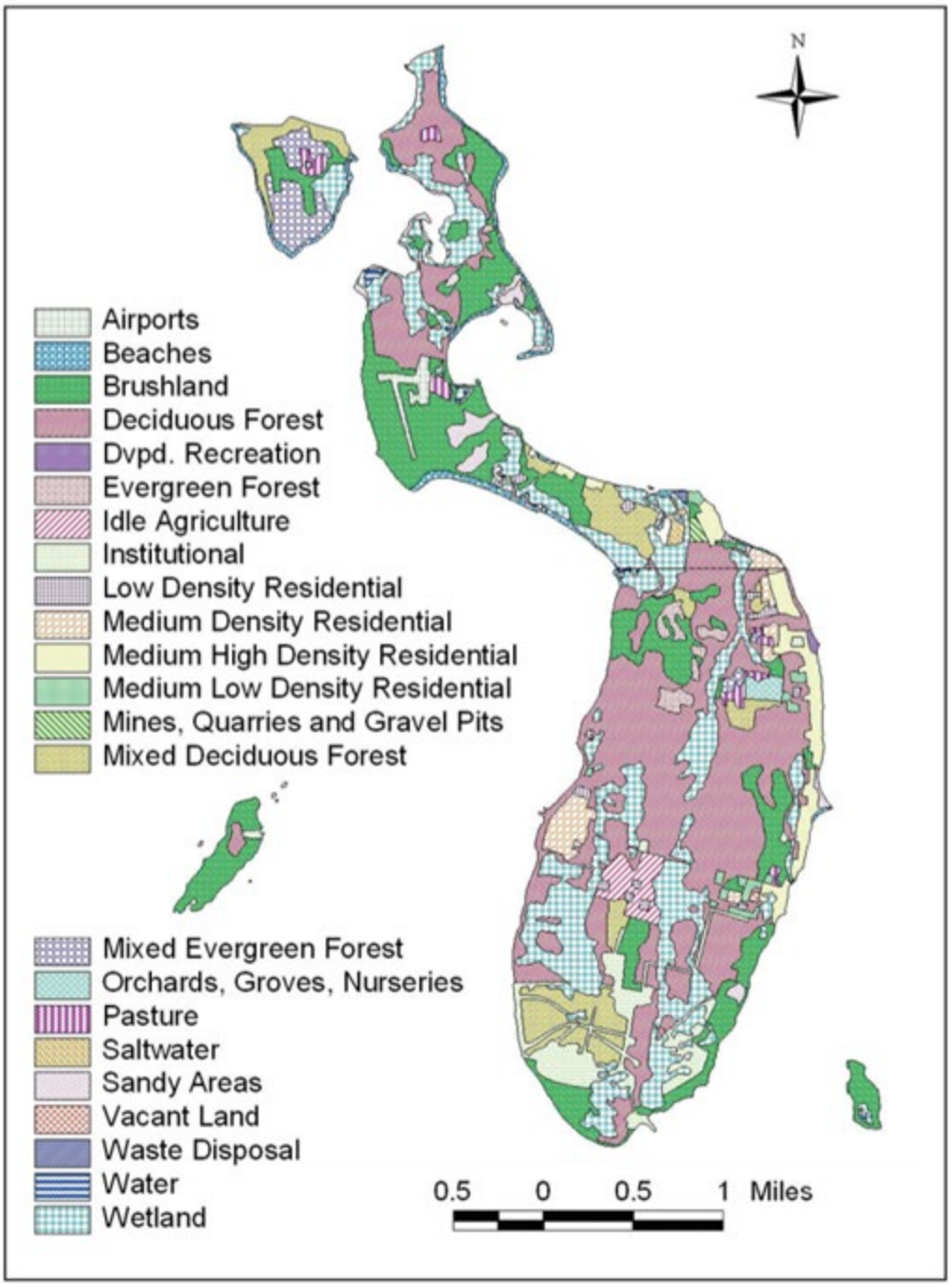

Figure 3.5: Land Cover Types at the NBNERR

As of this survey, Prudence Island has seven percent developed land cover, which is the least level of development of any of the large islands that constitute Rhode Island (Aquidneck, Conanicut, and Block). However, only 17 land cover classes were identified in the Reserve, due to the absence of orchards and nurseries, mines, quarries, developed recreation areas, waste disposal, and vacant lands. Patience Island is mostly natural land cover classes, including mixed evergreen forest (38 percent of the island), mixed deciduous forest (23 percent), brushland (14

percent), and wetlands (11 percent). The island has a small (less than one acre) residential development area from the period prior to state ownership of the island. Hope and Dyer islands are both largely composed of a single land cover class. There are 64 acres of brushland on Hope Island and 25 acres on Dyer, making up 85 percent and 86 percent of the two islands, respectively. The remaining area on Hope Island is deciduous forest and building remains from the Navy. For Dyer island, the remaining parts of the island are water or wetland. The 1995 survey indicated that habitat increases occurred on the South Prudence Unit where areas that were abandoned by the Navy began to revert to a more natural state. This shows the positive impact that protecting an area from development can do to increase natural land cover. It remains a priority for land managers to adopt strategies that protect threatened species and maximize local and regional biodiversity because of the history that poor management practices have had on the habitat of the reserve area (NBNERR Site Profile Pg. 33).

According to the same 1995 survey there are 10 types of wetlands found on Prudence, Patience, Hope, and Dyer islands although most of these are either deciduous forested wetlands or estuarine emergent wetlands (i.e., salt marshes). Almost 70 percent of all wetlands occurring on the four islands are protected within the boundaries of the Reserve, including 76 percent of all salt marshes. Prudence has a few small year-round ponds and contains approximately 15.5 km (9.7 miles) of streams and many vernal pools (exact number is unknown). Patience and Dyer islands do not support any standing freshwater ponds or streams (the stream on Patience Island is a salt marsh tidal creek). Hope Island has two streams in addition to two small freshwater ponds. The NBNERR includes approximately 18.2 miles (29 km) of estuarine shoreline between the four islands. The Reserve's shoreline is composed of five classes, including 15.5 km of beaches (mostly cobble, some sandy), 6.2 km of salt marsh (fringing and meadow marshes), 5.3 km of rocky shore, 1.9 km of upland, and 0.3 km of *Phragmites australis* (NBNERR Site Profile Pgs. 33-36).

Habitats found throughout the Little parcel include brushland, idle agricultural lands, deciduous forest, mixed deciduous forest, and wetlands. The acquisition would help to protect the salt marsh system on the west side of Prudence Island. The makeup of the expansion area is outlined in Table 3.1 below.

Table 3.1: Prudence Island Land Cover

Classification	Acres	% of Parcel
Brushland	643	19%
Developed Land	249	7%
Deciduous Forest	1,208	34%
Wetland	743	21%
Miscellaneous (mixed Deciduous Forest, idle agriculture)	695	19%
Total Acres	3,538.10	100%

Critical Habitat:

The Endangered Species Act (ESA) requires the designation of "critical habitat" for listed species when "prudent and determinable." Critical habitat includes geographic areas that contain the physical or biological features that are essential to the conservation of the species and that may need special management or protection. Critical habitat designations affect only Federal agency actions or federally funded or permitted activities. Federal agencies are required to avoid "destruction" or "adverse modification" of designated critical habitat. Critical habitat may include areas that are not occupied by the species at the time of listing but are essential to its conservation. An area can be excluded from critical habitat designation if an economic analysis determines that the benefits of excluding it outweigh the benefits of including it, unless failure to designate the area as critical habitat may lead to extinction of the listed species (FWS Endangered Species Basics). The ESA listed species located within the existing NBNERR and boundary expansion area are listed below in Table 3.3. None of the listed species has designated critical habitat within the reserve area or the expansion area.

Essential Fish Habitat:

Essential Fish Habitat (EFH) was defined by the U.S. Congress in the 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act, or Magnuson-Stevens Act, as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." Implementing regulations clarified that waters include all aquatic areas and their physical, chemical, and biological properties; substrate includes the associated biological communities that make these areas suitable for fish habitats, and the description and identification of EFH should include habitats used at any time during the species' life cycle. EFH includes all types of aquatic habitat, such as wetlands, coral reefs, sand, seagrasses, and rivers. The main purpose of EFH regulations is to minimize the adverse effects of fishing and non-fishing impacts on EFH to the maximum extent practicable. NMFS works with the New England Fishery Management Council to designate EFH.

The New England Council's approved role in managing fish habitat includes designating EFH and updating designations, as needed. There are presently 28 species' EFH designations in the New England area but EFH from the mid-Atlantic and highly migratory Atlantic species categories may have EFH present in Narragansett Bay. Other goals include documenting major threats to EFH from both fishing and non-fishing related activities, designating Habitat Areas of Particular Concern (HAPC), and revising habitat and groundfish management areas (New England Fishery Management Council Site).

Review of the EFH Mapper Tool can be used to identify the presence of EFH and HAPCs in Narragansett Bay. According to the NOAA EFH tool there are 20 EFH and two HAPC designations in the waters surrounding the NBNERR. Seven of those species are from the mid-Atlantic EFH category, ten are from the New England management, and three are highly migratory species. The species are listed in Table 3.2 under the region in which they are managed. The two HAPCs were for Inshore 20m Juvenile Cod and Summer Flounder.

Table 3.2: Essential Fish Habitat Present Surrounding NBNERR (Essential Fish Habitat Mapping Tool - NOAA)

Mid-Atlantic	**New England**	**Atlantic Highly Migratory**
· Atlantic Butterfish · Atlantic Mackerel · Black Sea Bass · Blue Fish · Longfin Inshore Squid · Scup · Summer Flounder	· Atlantic Cod · Atlantic Herring · Little Skate · Ocean Pout · Pollock · Red Hake · Silver Hake · Windowpane Flounder · Winter Flounder · Winter Skate	· Yellowfin Tuna · Sand Tiger Shark · White Shark

Terrestrial Habitats in the NBNERR:

The islands' general lack of top predators and limited emigration opportunities have led to the overpopulation of white-tailed deer, which may be affecting the entire ecology of the island system due to heavy browsing and grazing pressure. Also, the narrow shape of the islands offers interior plant species minimal protection from coastal winds and salt spray, which facilitates species adapted to coastal conditions, including aggressively colonizing invasive species such as oriental bittersweet and black swallowwort. Many remnant soils are nutrient poor and excessively drained, which tends to select for species communities adapted to poor soil conditions, such as pitch pine dominated mosaics, and relatively stable upland grassland habitats. Human modification of disturbance regimes such as the suppression of fire and localized flooding have limited the occurrence of certain expected early successional communities and favored progressive change towards more stable forest habitats and associated flora. Filling,

ditching, and movement of earth, which are evident in aerial photo archives, have also changed natural surficial water regimes.

Oriental bittersweet is an introduced vine that aggressively out-competes native flora by overtopping the plants and extorting light resources and nutrients. It occurs in virtually all properties of the Reserve, smothering flora and burdening shrubs and trees to the point of structural failure in many cases. The bittersweet drastically affects the ecology of many habitats, especially coastal shrublands and forests. Other invasive species found in the reserve include the beach rose found in dune shrublands. The common reed is rampant throughout emergent freshwater habitat and is present in many of the salt marsh systems; the multiflora rose is a staple species in coastal shrublands; the aggressive vine black swallow-wort is growing in multiple places; and autumn olive is common in shrublands. Black locust occurs throughout coastal forest habitats of the North Prudence and Patience Island units, where the sycamore maple and Norway maple have also escaped cultivation.

Terrestrial palustrine plant communities occupy 12 percent of all terrestrial habitats of the Reserve. These are overwhelmingly forested with a small fraction being shrubby. The freshwater wetlands of the NBNERR occupy hydric Scarboro mucky sandy loam and Stissing silt loam soils associated with the stream systems, groundwater seeps, and small perched depressions of Prudence Island. Emergent palustrine wetlands often occur as an early transitional stage after some type of disturbance. A lack of emergent wetland habitat in the Reserve may be indicative of a disruption of natural disturbance regimes such as fire and beaver damming. Wet meadows are extremely rich plant communities and due to the transient nature and dependence on disturbance, often support uncommon species. At least 85 percent of NBNERR terrestrial palustrine emergent habitats are affected by colonization of nonnative common reed.

Shrub wetlands are the median stage in wetland change progressions. NBNERR shrub wetlands exist as three types: mixed broad-leaved deciduous shrub swamps, thicket swamps, and sapling swamps. Shrub wetlands of the Reserve are edge communities, or transition zones between human-modified and forested wetland habitats. Mixed broad-leaved deciduous shrub swamps of the NBNERR are typically dominated by highbush blueberry, arrowwood, tree saplings, and alder. They are moderately affected by invasive species. Thicket swamps are dominated by Bebb's willow and speckled alder. Wetter habitats, such as thicket swamps, generally show less evidence of bittersweet invasion than drier shrub swamps.

NBNERR forested wetlands are dominated by red maple. Red maple swamps are associated with the Prudence Island's major stream basins. Red maple swamp overstory species include red maple and tupelo. Dominant understory species are northern arrowwood, highbush blueberry, and sweet pepperbush, with willow, swamp rose, bayberry, poison ivy, and greenbrier. These wetlands have only minor signs of invasive species. Natural upland plant communities occupy 45 percent of all terrestrial properties of the Reserve and are usually either forested or shrubby.

Coastal dune habitats generally occur along sandy shorelines as components of barrier beaches that separate meadow salt marshes from open water. Coastal dune habitat types include coastal dune sparse grassland, coastal dune grassland, coastal dune forbes, and coastal dune shrubland. Coastal dune grasslands' more abundant species are American beachgrass or quack grass. Coastal dune forb habitats are generally dominated by spearscale, beach pea, and water hemp,

and are usually disturbance-driven. Coastal dune shrubland habitats of the Reserve are typically dominated by beach rose, high tide bush, bayberry, or poison ivy. Coastal dune plant communities are susceptible to invasion by aggressive nonnative colonizers such as the oriental bittersweet.

Upland grass and forb plant communities are in a transient stage of successional development. These habitats exhibit varying landscape stability. Herbaceous communities occurring on richer soils are far less stable and must be regularly maintained to prevent the domination of woody vegetation. Reserve grasslands consist mostly of switchgrass, mixed cool-season grasses, or little blue-stem, while forb meadows are commonly filled by common milkweed or goldenrod. These grasslands have been shown to house the locally rare wildflowers, yellow thistle and sickle-leaved golden aster, NBNERR herbaceous communities are heavily impacted by nonnative species. In grassland communities, species such as fescues, English plantain, and black knapweed are nonnative.

Upland shrubland communities have three general types: coastal shrubland communities that are maintained by salt spray and high winds; greenbrier monocultures; and transient habitats occurring as a successional stage between herbaceous and forested uplands. Coastal shrubland types cover most of the undeveloped upland perimeters of Prudence and Patience Island properties, and most of the vegetated upland area of Hope and Dyer islands. Coastal shrubland community types identified in the Reserve are coastal shrubland, coastal greenbrier shrubland, coastal sumac thicket, and coastal dune shrubland. Coastal shrubland common species include smooth and shining sumacs, bayberry, greenbrier, or beach rose, as well as, black cherry, stunted eastern red cedar, fox grape, and poison ivy. Non-coastal shrublands have different dominant species such as highbush blueberry or bayberry, red maple, pitch pine, or gray birch saplings. Coastal shrublands are prone to invasion by the oriental bittersweet.

Upland habitats on the Prudence and Patience Island units are typically forested, while Dyer and Hope islands are more commonly coastal shrublands. Broad-leaved deciduous forested upland habitats generally grow on protected uplands with rich soils and are usually filled red maple, white oak, black oak, black locust, big-toothed aspen, sassafras, gray birch, tupelo, and naturalized sycamore maple. Needle-leaved evergreen forested uplands are composed of coastal eastern red cedar forest, pitch pine forests, open woodlands, and white pine. Eastern red cedar forests occur as dense thickets mostly on the coastal, Patience Island. NBNERR mixed-forest habitats have two types: oak-pine and cherry-cedar associations. Oak-pine associations have stages of specific plant domination ranging from pitch pine to oak in the absence of a regular fire treatment. They thrive in areas with relatively rich soils. Cherry-cedar communities are typically open canopy woodlands with dense shrubby understories. Cherry-cedar forests common species are red maple, wild black cherry, red maple, or black locust. In forests influenced by direct coastal effects, invasion by bittersweet is higher. The invasive common barberry is frequently found in the understory.

NBNERR pine barrens occur primarily on sandy, well-drained Poquonock soils. The pine barrens of the Reserve are composed of oak and pitch pine dominated forests and adjacent shrublands, grasslands, and sand barrens. Nearly half of the pine barren area within the reserve has progressed to closed canopy oak-pine forest. NBNERR pine barrens offer environmental

characteristics that support a wide range of specialized, unique, and rare plant and animal species. The Little property contains large portions of pine barren habitat.

3.2 Biological Environment

The Reserve contains a wide variety of biotic habitats ranging from estuarine, to upland, to freshwater aquatic communities. These habitats are home to various species of plants, invertebrates, herpetofauna, birds, fish, and mammals. Acquiring this land contributes to the development of a proposed natural corridor for species to more easily travel the length of Prudence Island.

3.2.1 Invertebrates

Few studies have been completed regarding terrestrial invertebrates. A study was performed on Dragonflies and damselflies by the Rhode Island Natural History Survey (RINHS) in 2001. In that study, nine species were collected: *Anax junius, Enallagma civile, Erythrodiplax berenice, Ischnura posita, Ischnura verticalis, Lestes rectangularis, Libellula pulchella, Pachydiplax longipennis,* and *Sympetrum rubicundulum*. Additional species, including *Pantala flavescens* and *P. hymenaea*, were found on Prudence Island in 2005. The dung beetle was also confirmed to be present on reserve grounds in the same 2005 study. Another previous invertebrate survey was of lepidoptera (butterflies and moths) and tiger beetles. The purpose was to determine the species composition, habitat use, and distribution of these invertebrates was conducted on Prudence Island. Five major habitat types were sampled, including grasslands, grassland/ shrub mixes, pine barrens, forest/wetland borders, and dunes. From these efforts, 385 species of macrolepidoptera (large moths), 127 species of microlepidoptera (small moths), 33 butterfly species and five tiger beetle species were collected. Two species of lepidoptera*, Zanclognatha martha* (pine barrens Zanclognatha moth) and *Poanes viator* (broad-winged skipper) are listed as species of concern in the state. Three species of tiger beetles that were found are also listed in the state, including *Cicindela marginata, C. purpurea*, and *C. tranquebarica*. These species of concern are affiliated with grasslands and/or pine barrens, further indicating the importance of maintaining and restoring these habitats on Prudence Island. The ticks on Prudence Island have been studied to a greater degree than other invertebrates due to interest in tick-borne diseases. These studies have, because of the attention, led to an increased understanding of the ecology of these species. Prudence Island is a site where residents and visitors alike exhibit high incidence rates of tick-borne diseases including Lyme disease, babesiosis, and ehrlichiosis. The island's abundant tick populations are largely due to an overabundance of white-tailed deer and extensive habitat conditions conducive to tick survival. These conditions are made possible by the maritime island climate and heavy brush and vine cover (e.g., bittersweet). The three tick species on Prudence Island are the deer tick, dog tick, and lone star tick. Multiple studies help create a pattern which indicates that most deer ticks were found at the south end of the island, while most lone star ticks were found at the north end. Dog ticks were evenly distributed throughout the island. These studies suggest that the dominant species on Prudence Island is probably the lone star tick, *A. americanum*. Further studies showed that nymphal deer ticks were overwhelmingly more abundant on lawns adjacent to woods than on lawns adjacent to other lawns. Also, nymphal deer tick abundance decreased with increasing distance from woods. The prevalence of the Lyme disease–causing spirochete on ticks did not differ between lawn types or among different

distances from woods. This indicates that although the risk is decreased, it is still possible to contract Lyme disease on mowed residential lawns. At present there is only a basic understanding of terrestrial invertebrate species that are present in the Reserve and in other areas of Prudence Island. Existing species lists are not comprehensive (NB NERR Site Profile Pg. 57).

Plankton

Narragansett Bay has historically been considered a phytoplankton-based estuary. Phytoplankton composition and production is variable among regions of the Bay and over different temporal cycles. It is directly grazed by zooplankton in the water column and provides a critical food source for benthic organisms. The number of phytoplankton species present in Narragansett Bay is predictably variable among different studies where the variability in the number of phytoplankton species is to differences in the timing, location, and techniques. Consistently, however, results show that dinoflagellates and diatoms are the most common phytoplankton in Narragansett Bay. Diatoms and flagellates follow an alternating cycle of abundance in Narragansett Bay. Diatoms tend to dominate during late winter through spring (January through May), when flagellate abundance is lowest. Diatoms begin to decline in the spring when flagellate numbers begin to rise, and by early summer flagellates reach their annual maximum. Diatoms again dominate at the end of the summer but fall off again in late autumn. *Skeletonema grethae* was, substantially, the most abundant phytoplankton found during studies of the bay. In addition to *S. grethae, Detonula confervacea, Asterionella glacialis, Olisthodiscus lutues*, and *Thalassiosira nordenskioeldii* were all found in high numbers in Narragansett Bay. However, *D. confervacea* which is a winter phytoplankton occurring between January and March, is occurring less frequently due to warming water temperature. *A. glacialis* was present throughout the year and was most abundant in late summer and winter. *O. lutues*, which occurred from May through December, had high abundance when *S. grethae* populations were less frequent. Phytoplankton biomass (expressed as chlorophyll a) generally exhibits variable seasonal patterns in Narragansett Bay. The winter-spring phytoplankton bloom varies by year (in time and magnitude), but typically occurs between November and March. Major blooms are not restricted to the annual winter-spring bloom and can occur at most times of the year. The frequency and magnitude of blooms were higher from late autumn through spring (e.g., October to April) than during the summer. Phytoplankton dynamics in Narragansett Bay are affected by numerous, often interacting factors including light, temperature, nutrient concentrations, grazing, and competition among other phytoplankton species. Phytoplankton abundance and biomass predictably vary among different areas of Narragansett Bay. Phytoplankton abundance and biomass is higher in the upper regions of the Bay, including the Providence River and Mount Hope Bay. This pattern may be a result of increased nutrient input into the upper Bay from sewage plants and other inputs, and to greater mixing with nutrient-poor shelf water lower in the Bay (NB NERR Site Profile Pg. 109).

The zooplankton community in Narragansett Bay can be grouped according to size and type. The three general size groups of zooplankton include microzooplankton, mesozooplankton, and macrozoplankton. In addition, the two types of zooplankton include the holoplankton, which spend their entire lives as plankton, such as copepods, and meroplankton, which include planktonic larval stages of animals such as bivalves and worms. The most common group of zooplankton in Narragansett Bay is copepods. The Bay's most frequent of these copepod species are *Acartia tonsa* and *Acartia hudsonica*. Other less encountered species include certain

meroplankton (e.g., bivalve larvae, polychaete larvae), rotifers, the cladoceran, *Podon polyphemoides*, and in the summer, *M. lledyii*. Zooplankton in Narragansett Bay varies seasonally in terms of species composition, total abundance, and total biomass, and these changes are generally in response to temperature. Of the two most common copepods, *A. hudsonica* is abundant in winter and spring, and *A. tonsa* will be more abundant in summer and fall. Recent work has shown a change in *M. lledyii* abundance in response to warming temperatures, resulting in a concurrent near extirpation of *A. tonsa*. Overall peaks in zooplankton biomass can occur in spring (March through May), summer (primarily July), and, to a lesser extent, in early fall (September-October). Zooplankton biomass does not appear to differ substantially between upper and lower Bay areas, except near the Bay mouth where biomass drops quickly as coastal species replace estuarine species (NB NERR Site Profile Pg. 112).

Benthic organisms are living within or directly on the surface of the sediments or hard-bottom substrates within Narragansett Bay. This includes infauna and epibenthic organisms such as polychaete worms, nematodes, bivalves, and amphipods and other small crustaceans. Benthos and its associated communities play an integral role in Bay-wide processes and are intimately coupled with the water. Using multiple past studies, some frequently caught benthic species include *Nephtys incisa, Nucula annulata, Mediomastus ambiseta*, the polychaete *Streblospio benedicti*, and the tube-dwelling amphipod *Ampelisca spinipes*. Other larger species include the commercially important quahog clam, the mat-forming slipper-shell clam, and the bed-forming blue mussel. Benthic communities in Narragansett Bay vary over multiple scales ranging from sub-meter to multi-kilometer as a result of the influence of a variety of independent and interacting factors, including sediment type and grain size, sediment organic content, anthropogenic inputs, salinity, and oxygen concentration. The benthos is also largely affected by the amount of organic matter that is produced by phytoplankton in the overlying water column. Narragansett Bay benthic communities do not generally exhibit a strong north-south gradient throughout the length of the Bay. The most extensive benthic community in Greenwich Bay was *A. spinipes*, which was associated with mud sediments. In contrast, sandy sediments were dominated by the slipper-shell clam and other associated species such as the jingle shell, *Anomia simplex*, and the clam worm, *Nereis succinea*. Benthic meiofauna and macrofauna exhibit similar patterns across the seasons and these patterns are in part related to plankton dynamics in the overlying water column. The signature seasonal pattern is one of increased abundance and biomass in spring (i.e., May and June), followed by a decrease in both summer and fall. It is likely that the increase in biomass and abundance in spring is primarily a response to the deposition and accumulation of organic matter from the winter-spring phytoplankton bloom (zooplankton predation during this time is largely minimal due to cold water temperatures). (NB NERR Site Profile Pg. 113).

Ichthyoplankton are early life-history stages of nekton (free-swimming organisms) and are particularly abundant in estuaries due to estuaries' function as a nursery or spawning area for certain species. Multiple studies into Ichthyoplankton have shown that they display a clear seasonal pattern in abundance, with a distinct peak in eggs in June and in larvae slightly later in July. The same studies showed an average of approximately 40-45 distinct species present in the bay. The most frequently occurring species were, at separate points in time, the cunner, tautog, bay anchovy, Atlantic menhaden, scup, and weakfish. Species densities were lower in later studies (conducted in 1990) compared with studies from the 1970s. Abundance of some species declined substantially in the highly impacted upper Bay, Providence River, and Greenwich Bay

areas. There was a general shift in ichthyoplankton distribution down-Bay away from these impacted areas. The cause of this shift is thought to be, at least partially, caused by human impacts (NB NERR Site Profile Pg. 131).

3.2.2 Fish

Fish are a critical functional component of estuarine ecosystems. Some estuarine fish species are commercially and recreationally important, while others provide food for birds, mammals, and other fish. Some species of fish can physically transfer organic materials between intertidal and subtidal estuarine habitats, and as a guild, fish can be used as an indicator of estuarine condition. In some situations, fish can exert substantial top-down control over estuarine system processes. Narragansett Bay provides refuge, spawning, and foraging habitats for a diverse assemblage of fish species. Due to its location in southern New England, Narragansett Bay supports species from northern, boreal areas as well as species from subtropical and tropical climates over an annual cycle. These species include permanent and seasonal residents, seasonal and occasional visitors, anadromous and catadromous species, and accidentals and strays. Narragansett Bay provides support functions for all life history stages of fish, including planktonic, larval, juvenile, and adult stages.

Open-water Fish Species

Early studies, from the 1970s, discovered around 45 species in Narragansett Bay. The catch had a small number of those species make up 90 percent of the total fish caught indicating dominance by those fish. This early study also provided some key conclusions such as the composition of the fish community in Narragansett Bay is comparable to those in Block Island and Long Island sounds, fish abundance and biomass per unit area are comparable to other New England coastal and offshore areas, winter flounder was the most abundant species, species diversity was highest near the mouth of the Bay, and the demersal fish in Narragansett Bay may be important in regulating the diversity and abundance of the benthos. Approximately 100 different types of fish species have been found in long-term trawling surveys of the bay with an average of about 45-55 species being found per year. The five most frequently caught species were the bay anchovy (51 percent of total abundance), scup (19 percent), longfin squid (8 percent), menhaden (6 percent), and butterfish (5 percent). In terms of biomass the most common species scup (19 percent), winter flounder (18 percent), American lobster (9 percent), skates (Rajidae, 9 percent), windowpane flounder (6 percent), longfin squid (6 percent), tautog (6 percent), butterfish (5 percent), summer flounder (4 percent), bay anchovy (3 percent), weakfish (2 percent), Atlantic herring (2 percent), and bluefish (2 percent). Biomass indicates that the bay is dominated by demersal species whereas abundance shows that schooling, pelagic species dominate the bay. There is no clear trend in the annual number of species in Narragansett Bay, nor is there a trend in total fish biomass over time. In contrast, total abundance is tending to increase over time, mostly due to increases in small pelagic schooling fish such as Atlantic menhaden and bay anchovy. The Bay is undergoing a shift from a community dominated by demersal species to a system dominated by pelagic species (possibly due to human impacts). The abundance of the commercially important winter flounder has been in steady decline since at least the beginning of the survey, and this decline is evident throughout Narragansett Bay. Similar patterns have been observed for other demersal species, including those that are not exposed to fishing pressure (e.g., hogchoker; NB NERR Site Profile Pg. 125).

Shore-zone and Intertidal Fish Species

Shallow estuarine waters provide critical nursery habitats for juvenile estuarine fish and permanent habitats for some abundant forage species. These types of habitats are often at risk, however, due to their proximity to the land and thus the activities of humans. Species in shallow, shore-zone habitats are monitored monthly from June through October by RIDEM with a juvenile finfish seining survey at 20 nearshore stations in Narragansett Bay. A total of 78 species have been collected using said program. The most common species found were Atlantic menhaden (62 percent of total abundance), silversides (8 percent), river herring species (6 percent), bluefish (4 percent), winter flounder (3 percent), striped killifish (3 percent), sea herring species (3 percent), and bay anchovy (2 percent). In addition, it was found that total abundance, species richness, and the number of winter flounders were highest at an upper Bay station. Saltwater marshes in Rhode Island support diverse and productive fish communities, as well. Studies of marsh species showed a consistent pattern of low species diversity while density would vary between marshes and within any marsh. These species include the common mummichog, striped killifish, sheepshead minnow, Atlantic and inland silversides, and grass shrimp. Less abundant, though ecologically important, species that also use Narragansett Bay salt marshes include juvenile winter flounder, sticklebacks, American eel, and blue crab. Marsh nekton species can move among and utilize multiple marsh habitats (e.g., creeks, pools, vegetated marsh surface) depending on life history stage and tide stage. Fish tend to be more abundant in subtidal, rather than intertidal, marsh creeks (NB NERR Site Profile Pg. 130).

3.2.3 Wildlife

Reptiles and Amphibians

Inventories between 1985 and 1988 showed no herpetofauna on Patience or Dyer Islands. Based on these surveys, three species were documented on Hope Island, and 15 species were identified on Prudence Island. In contrast, 45 species are reported to occur in the whole of Rhode Island. Thus, compared to the mainland, Patience, Hope, and Dyer islands are much less diverse with regards to herpetological fauna (based on limited information), while Prudence Island, despite its relatively small size compared to the mainland, supports just under half of all Rhode Island species. Studies began again in 2003, updating the numbers of herpetofauna to 17 species on Prudence Island and three on Hope Island; Patience and Dyer Islands show no signs of herpetofauna species presence. NBNERR surveys were conducted on Prudence Island and included spotted salamander egg mass counts, anuran (frogs and toads) calling surveys in permanent and vernal ponds, and salamander counts using artificial cover boards. Three of the seven ponds surveyed on Prudence Island contained spotted salamander egg masses, with one pond containing the highest recorded amount in Rhode Island. Anural call surveys were conducted at seven permanent and vernal ponds on Prudence Island on six dates. These anuran calling surveys documented one species, the Northern spring peeper, which was present in each pond surveyed showing distribution throughout the island. Activity levels of the spring peeper varied sharply in late April. Salamander surveys indicated three species of salamanders were present; Northern redback, spotted, and four-toed. Of these, the Northern redback salamander was by far the most abundant species (87 individuals out of 92 total salamanders). A single study in 1981 documented the presence of northern diamondback terrapins, however, their presence is unconfirmed (NB NERR Site Profile Pg. 58)

Sea Turtles

Sea turtles are regularly sighted in state waters from late June through October, on their southward migration for winter. Occurrences of leatherback (*Dermochelys coriacea*), loggerhead (*Caretta caretta*), and Kemp's ridley (*Lepidochelys kempi*) sea turtles have been recorded in the bay. The leatherback is pelagic, traversing Rhode Island Sound but rarely coming further into the bay. However, sightings occasionally happen. The loggerhead and Kemp's ridley sea turtles have been sighted, as well, in the Bay near Conanicut and Aquidneck islands and most likely venture into NBNERR waters (NB NERR Site Profile Pg. 145).

Birds

Maritime bird nesting sites have been identified throughout coastal Rhode Island and in the Reserve on Hope, Dyer, and Prudence islands. Composition and abundance of maritime nesting birds at individual sites can vary considerably over time due to factors that include the return of long-displaced species to Narragansett Bay and significant disturbance-mediated movements of species among island nesting sites. Despite its relatively large size, in 1998, Prudence Island had only one location that had been identified as a maritime bird nesting site, Gull Point on the northern part of Potter Cove. That study also indicated that other maritime birds had historically nested on Prudence Island before their study began. Hope and Dyer islands continually support substantial colonies of nesting maritime birds despite their small size. For example, in 2003 Dyer Island supported over 429 nests of gulls (290 herring gulls, nests; 139 great black-backed gulls, nests) and was one of only 10 sites in Rhode Island used by nesting American oystercatchers. Hope Island presently supports an abundant heronry. Of the three sites in Rhode Island, Hope Island supports the largest colony of black-crowned night herons, herring gulls, great black-backed gulls, and double-crested cormorants. Hope Island represents such an important nesting area that the state closes the island to human use throughout the nesting period (April 1 through August 15). Surrounding Hope Island are three rocky outcrops, known as Little Gooseberry Island, Despair Island, and Scup Rock, that are also nesting sites for maritime birds including herring gulls, great black-backed gulls (Little Gooseberry Island and Scup Rock), and common terns (Despair Island) (NB NERR Site Profile Pg. 61).

Breeding songbirds were only surveyed once in 1985 on Patience Island, and a total of 324 individual birds representing 35 species were found, although not all of them were confirmed as breeding. The most abundant species were gray catbird (17 percent of the total number of birds), common yellowthroat (16 percent), rufous-sided towhee (10 percent), yellow warbler (5 percent), American redstart (5 percent), and white-eyed vireo (5 percent). Red-winged blackbird, sharp-tailed sparrow, and saltmarsh sparrow were observed near the salt marsh along the southeast side of the island, while European starling, house finch, and rock dove were observed in human-modified habitats (open clearings and buildings). Other species found in separate surveys found the American robin, and house wren. It seems that the most abundant songbird species on Prudence and Patience islands is the gray catbird. It was the most abundant species on Patience and Prudence, and the high abundance of this species is undoubtedly due to the proliferation of the thick undergrowth, brush, and thorn-scrub habitats that this species prefers. Additional studies at late points in time found the same most abundant species where they were observed at the highest number of survey points (i.e., most frequently) indicating their universal distribution on the island. A mist net study also indicated the presence of the yellow-rumped

warbler, ruby-crowned kinglet, song sparrow, and black-capped chickadee. Peak captures for this study came in mid-October. Species diversity, in comparison to Block Island, was not high but studies of that island showed diversity rates higher than most parts of North America. The salt marshes on Prudence Island support populations of the salt marsh sharp-tailed sparrow. Adult return rates (after migrating) of adult sharp-tailed sparrows did not differ between marshes on Prudence Island and mainland sites. It was also found that individual sparrows often moved between nearby marshes on Prudence Island but that movements between Prudence and mainland marshes did not occur (NB NERR Site Profile Pg. 62).

The Eastern bluebird, turkey vulture, snow bunting, and yellow-breasted chat have all been observed on Prudence Island since 2001, bringing the total number to 155 species. This relatively high number probably results from multiple interacting factors, including the diversity of terrestrial and estuarine habitats found around the Reserve, the amount of protected open space on the islands, and the level of effort devoted to surveying birds in the area (i.e., more effort can lead to more species observed). The diversity of habitats found on the island undoubtedly attracts birds. The coastline of Prudence Island is composed of numerous shallow coves that provide protected habitats for rafts of migratory ducks (e.g., bufflehead, merganser, goldeneye) and other species throughout the winter. The dry, sandy areas at the south end and central portions of the island support pine barrens and open grasslands that are utilized heavily by species such as red-tailed hawk and American kestrel. The numerous meadow and fringe marshes, particularly on the northern half of the island, provide important foraging habitat for wading birds such as great egret, snowy egret, great blue heron, and glossy ibis. The marshes also provide overwintering habitat for ducks, geese, and other species. Numerous small streams that empty into Narragansett Bay from Prudence Island provide freshwater to coastal birds and attract dense concentrations of species such as herring gull, great black-backed gull, brant, Canada goose, mute swan, ducks, and crows. The relatively isolated nature of all four of the islands may also help attract large numbers of maritime wading birds. None of the islands is directly accessible by car (cars on Prudence arrive by ferry), and all but Prudence receive very few visitors. Birds on all the islands, Prudence included, generally receive very little disturbance from humans. Species that occur in noticeably low numbers in each study represent those that are often associated with humans, such as the house sparrow, rock dove, and common grackle. Human development is limited on Prudence Island, and these species are probably not abundant on an island-wide basis (NB NERR Site Profile Pg. 65).

Aquatic Birds

Colonial Nesting Birds

Many of the undeveloped Narragansett Bay islands support abundant and sometimes diverse nesting bird communities. Hope, Rose, and Little Gould islands support rich heronries (mixed-species aggregations of nesting herons and egrets), while gulls/cormorants are abundant on Hope, Dyer, Little Gould, and West islands, among others. These species include gulls (primarily herring gull and great black-backed gull), terns (common tern and least tern), waders (great egret, snowy egret, cattle egret, little blue heron, and glossy ibis), piping plover, double-crested cormorant, and American oystercatcher. To date, approximately 90 nesting locations have been identified along the Rhode Island coast. The double-crested cormorant (hereafter cormorant since the great cormorant is generally much less abundant in Narragansett Bay) is now a conspicuous

and abundant seasonal component of the estuarine bird fauna in Narragansett Bay. Cormorants are present throughout the year in Narragansett Bay but are much more common in summer and are especially abundant during the spring and fall migrations. Cormorants can be seen foraging and resting throughout most areas of the Bay, including open water, coves, embayments, and marinas. Abundant nesting colonies are generally found on only a handful of islands, including Little Gould, West, and East islands (all of which are found in the Sakonnet River) and Hope Island in the West Passage. The abundance of cormorants has risen to such a degree that there is now concern about their potential impacts to commercial fishery stocks (e.g., winter flounder) in Narragansett Bay. Wading bird colonies, composed of species such as great egret, snowy egret, cattle egret, little blue heron, and glossy ibis, are found on a few of Narragansett Bay's islands including Hope, Little Gould, and Rose islands. The species composition of the Hope Island heronry is variable among years, but can include great egret, snowy egret, black-crowned night heron, glossy ibis, cattle egret, and little blue heron—all of which nest among abundant gull and cormorant populations. These events clearly indicate that the spatially and temporally dynamic nesting patterns of herons, egrets, and associated nesting birds necessitates the protection and preservation of natural habitats on other Narragansett Bay islands. Herons and egrets are commonly observed foraging in fringing and meadow salt marshes around Narragansett Bay, and it is generally accepted that marshes provide important foraging habitat for these birds. The number of birds foraging in a marsh correlates well with marsh area, but bird density does not (i.e., as marsh area increases, so does the number of foraging birds but not bird density). Wading birds strongly preferred isolated salt marsh pools as foraging microhabitat within a marsh, and the lack of marsh pools (often resulting from ditching) is the primary factor limiting the abundance of these birds on a Bay-wide scale (e.g., the number of wading birds nesting in Rhode Island has remained stable in recent years even though not all potential nesting areas are used in any given year) (NB NERR Site Profile Pg. 141).

Waterfowl

Narragansett Bay is used extensively by a variety of waterfowl that includes diving and dabbling ducks and swans and geese. While some of these species (e.g. Canada goose, American black duck, and mallard) utilize Bay waters throughout the year, many others use the Bay primarily for overwintering. The most abundant species according to these surveys are scaup, Canada goose, common goldeneye, common eider, and brant. Twelve additional waterfowl species were regular winter inhabitants. Waterfowl species do not appear to be randomly located around Narragansett Bay; instead, these birds may select for specific habitats that have certain landscape characteristics. For example, specific groups of waterfowl in Narragansett Bay were found to be associated with salt marsh–dominated coves or rocky headland habitats near the mouth of the Bay. Waterfowl using salt marsh and shallow cove habitats favored sites that were abutted by forest and residential land-use types (NB NERR Site Profile Pg. 142).

Mammals

Information about mammals on Prudence Island dates back to the 1950's where animal data was obtained mainly by trapping and collections of roadkill and the information was not captured through focused surveys so it's not a precise list of species. Based on this survey, gray squirrel, white-footed mouse, meadow vole, muskrat, Norway rat, red fox, raccoon, mink, striped skunk, and white-tailed deer were all present. It is also expected that the white-footed mouse, the house

mouse, eastern cottontail rabbit, and little brown, big brown, and red bats were present on Prudence Island during the time of the survey.

The NBNERR conducted mammal surveys as recently as 2003. The two components of this effort include driving surveys around Prudence Island to document all visible wildlife and scent stations to determine the presence and distribution of mammalian scavengers and predators on each island. Red fox and raccoon were observed distributed around scent stations throughout Prudence Island indicating a universal presence on the island. Feral cats were also observed using the same scent stations. Dyer and Hope islands are not known to have predatory mammals present. Although extremely limited, these results support the premise that these islands are not inhabited by predatory mammals. Based on the 2003 study, eight mammal species were observed on Prudence Island, including white-tailed deer, Eastern cottontail rabbit, Eastern gray squirrel, red fox, raccoon, feral cat, mink, and northern river otter.

Some species exhibited clear seasonal patterns that may reflect real changes in abundance throughout the year (e.g., more eastern cottontail rabbits are born into the population in spring and summer). Other changes may simply be due to changes in the detection ability of the observer. For example, the fewer sightings of gray squirrels in summer may simply be due to the difficulty of seeing these smaller animals through thick summer vegetation and leaves in which they are found. The most recent confirmed mammal species present on Prudence Island is the coyote. The presence was confirmed using anecdotal accounts from Prudence Island residents and collections of coyote scat. Based on the limited information available, approximately 15 species of mammals are currently present on Prudence Island. The dearth of information limits the confidence that 15 is the actual number of species present.

The white-tailed deer is the most abundant medium-to-large mammal species present on Prudence and Patience islands. White-tail deer were, by a large margin, the most abundant species found during the 2003 NBNERR studies. Deer are readily visible on much of the island throughout the year and serve as a crucial game species and as an important member of the NB NERR food web. To avoid population overabundance, hunting quotas are permitted for the white-tailed deer. Overabundance impacts can include altered or degraded forest understory, a reduction in food and cover for other species and an increase in the abundance of ticks and the incidence of tick-borne diseases among humans. The absence of the white-tailed deer from Hope and Dyer islands helps to limit the abundance of ticks and probably helps limit the distribution of invasive species, such as Asiatic bittersweet. Thus, the absence of deer from these islands may help result in different floral and faunal communities compared to Prudence and Patience islands (NB NERR Site Profile Pg. 68).

Marine Mammals

Among the marine mammals that are found in Narragansett Bay, the harbor seal is the only regular, abundant species. Harbor seals typically arrive in Narragansett Bay in late September or early October, increase in numbers through March, and leave the Bay by early May. While they are in Narragansett Bay, harbor seals forage in subtidal areas and use rocky outcrops as haul-out sites for resting. Seal Rock (off Hope Island) supports large numbers of hauled out seals, but it is monitored too infrequently to assess true haul-out patterns. Temperature and wind speed were not observed to influence the numbers of seal haul out numbers and how many were showing

scanning behavior. Harbor seal populations have been increasing throughout much of the northwest Atlantic, including in Narragansett Bay, where a steadily increasing population uses an increasing number of haul-out sites. Higher numbers of seals have prompted concern over the resultant effects on commercially important fish stocks in the region. However, studies show that these concerns may be largely unwarranted in Narragansett Bay. Narragansett Bay is not commonly frequented by marine mammals. The amount of information available on marine mammal populations is limited but 15 additional species of marine mammals have been previously sighted (dead or alive) at some point in Narragansett Bay or along the south shore of Rhode Island. These species include the gray seal, harp seal, hooded seal, North Atlantic right whale, humpback whale, fin whale, northern minke whale, dwarf sperm whale, long-finned pilot whale, Risso's dolphin, Atlantic white-sided dolphin, bottlenose dolphin, striped dolphin, harbor porpoise, and West Indian manatee (NB NERR Site Profile Pg. 143).

3.2.4 Protected Species

NBNERR is the native habitat for many bird, aquatic and terrestrial mammal, fish, reptile, plant, and invertebrate species (among others). A number of these species are designated by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service as either threatened or endangered. Threatened or endangered species that are known to occur in the NBNERR area or that might be affected by the boundary expansion are listed in Table 3.3. Descriptions of the listed species are included after the table.

The Little property area potentially contains habitat for the federally-listed Northern long-eared bat (*Myotis septentrionalis)* and Roseate tern (*Sterna dougallii*) as well as other state species of concern including the margined tiger beetle (*Cicindela marginata*) and dark-bellied tiger beetle (*Cicindela tranquebarica*). It is likely that the locally-rare pine barrens are also home to other species of state concern, including various moths and birds.

Table 3.3. Listed Species of Fauna Located within the Existing NERR or Boundary Expansion Area

Common Name	**Scientific Name**	**Listing Status under ESA**	**Critical Habitat?**
Mammals			
Northern Long-eared Bat	*Myotis septentrionalis*	Threatened	No
Turtles			
Hawksbill Turtle	*Eretmochelys imbricata*	Endangered	No
Kemp's Ridley Turtle	*Lepidochelys kempii*	Endangered	No
Leatherback Turtle	*Dermochelys coriacea*	Endangered	No
Loggerhead Turtle	*Caretta*	Endangered	No
Atlantic Green Turtle	*Chelonia mydas*	Threatened	No
Fish/Sharks			
Atlantic Salmon	*Salmo salar*	Endangered	No
Atlantic Sturgeon	*Acipenser oxyrinchus*	Endangered	No
Giant Manta Ray	*Manta birostris*	Threatened	No
Shortnose Sturgeon	*Acipenser brevirostrum*	Endangered	No
Oceanic Whitetip Shark	*Carcharhinus longimanus*	Threatened	No
Birds			
Roseate Tern	*Sterna dougallii*	Endangered	No

Source: https://ecos.fws.gov/ipac/project/ and USFWS email dated March 31, 2021

Mammals:

Northern-Long Eared Bat (*Myotis septentrionalis*); ESA Threatened; State Species of Concern

The northern long-eared bat is a medium-sized bat about 3 to 3.7 inches in length but with a wingspan of 9 to 10 inches. As its name suggests, this bat is distinguished by its long ears, particularly as compared to other bats in its genus, *Myotis*. The northern long-eared bat is found

across much of the eastern and north central United States and all Canadian provinces from the Atlantic coast west to the southern Northwest Territories and eastern British Columbia. The species range includes 37 states. White-nose syndrome, a fungal disease known to affect bats, is currently the predominant threat to this bat, especially throughout the Northeast where the species has declined by up to 99 percent from pre-white-nose syndrome levels at many hibernation sites.

The status and distribution of this species in Rhode Island is not well understood. Prior to the impacts of White nose syndrome this species was probably more common and widespread than it is today. Northern Long-eared Bats utilize a wide variety of forest types during the summer. They utilize forest roads and openings in the forest as well as various water bodies such as ponds and streams for foraging for insects and roost in tree cavities and under loose bark. Northern Long-eared Bats were recently discovered hibernating in small numbers in underground bunkers along the south coast. Current threats to the species include invasive and other problematic species and genes; introduced disease, white-nose syndrome (WNS); residential and commercial development; habitat loss of maternal roost sites (e.g., old barns, snags, other man made and natural structures); human intrusions and disturbance; human activities interfering with security of winter hibernation; biological resource use; demographic changes from incidental take (human); residential and commercial development; habitat loss of critical micro-features; pollution; widespread pesticide use for insect control potentially reduces prey source for bats.

Aquatic Species:

Turtles:

Hawksbill Turtle (*Eretmochelys imbricata)*; ESA Endangered

The endangered Hawksbill Sea Turtle is one of seven species of sea turtles found throughout the world (with a historical range including Rhode Island). One of the smaller sea turtles, it has overlapping scutes (plates) that are thicker than those of other sea turtles. This protects them from being battered against sharp coral and rocks during storm events. Adults range in size from 30 to 36 inches (0.8-1.0 meters) carapace length and weigh 100 to 200 pounds (45-90 kilograms). Its carapace (upper shell) is an attractive dark brown with faint yellow streaks and blotches and a yellow plastron (under shell). The name "hawksbill" refers to the turtle's prominent hooked beak.

The decline of this species is primarily due to human exploitation for tortoiseshell. Other threats include loss or degradation of nesting habitat from coastal development and beach armoring; disorientation of hatchlings by beachfront lighting; nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; watercraft strikes; and incidental take from commercial fishing operations. Continued efforts are needed to protect nesting beaches; minimize the threat from illegal exploitation through intensified law enforcement efforts to curb the incidence of poaching and harassment; maintain the ban on international trade in hawksbill products; and ensure long-term protection of important foraging habitats by designating them as marine sanctuaries or as State, territorial, or Commonwealth aquatic preserves or sanctuaries.

Kemp's Ridley Turtle (*Lepidochelys kempii)*; ESA Endangered; State Species of Concern

The Kemp's Ridley turtle is the smallest of the sea turtles, with adults reaching about 2 feet in length and weighing up to 100 pounds. The adult Kemp's Ridley has an oval carapace that is almost as wide as it is long and is usually olive-gray in color. The carapace has five pairs of costal scutes. In each bridge adjoining the plastron to the carapace, there are four inframarginal scutes, each of which is perforated by a pore. The head has two pairs of prefrontal scales. Hatchlings are black on both sides. The Kemp's Ridley has a triangular-shaped head with a somewhat hooked beak with large crushing surfaces. This turtle is a shallow water benthic feeder with a diet consisting primarily of crabs.

The species' historical range includes Rhode Island and will uncommonly stray into Rhode Island marine waters during late summer. The decline of this species is primarily due to human activities, including the direct harvest of adults and eggs and incidental capture in commercial fishing operations.

Leatherback Turtle (*Dermochelys coriacea)*; ESA Endangered; State Species of Concern

The leatherback is the largest, deepest diving, and most migratory and wide ranging of all sea turtles. The adult leatherback can reach 4 to 8 feet in length and 500 to 2000 pounds in weight. Its shell is composed of a mosaic of small bones covered by firm, rubbery skin with seven longitudinal ridges or keels. The skin is predominantly black with varying degrees of pale spotting, including a notable pink spot on the dorsal surface of the head in adults. A toothlike cusp is located on each side of the gray upper jaw; the lower jaw is hooked anteriorly. The paddle-like clawless limbs are black with white margins and pale spotting.

The Leatherback's historical range includes Rhode Island and is the most common of the sea turtles to inhabit Rhode Island waters but is still uncommon in occurrence with most appearances being in late summer. The main cause of population declines was exploitation by humans for the eggs and meat, as well as incidental take in numerous commercial fisheries. Other factors threatening leatherbacks globally include loss or degradation of nesting habitat from coastal development; disorientation of hatchlings by beachfront lighting; nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; and watercraft strikes.

Loggerhead Turtle (*Caretta caretta);* ESA Endangered; State Species of Concern

The loggerhead is characterized by a large head with blunt jaws. The carapace and flippers are a reddish-brown color; the plastron is yellow. The carapace has five pairs of costal scutes with the first touching the nuchal scute. There are three large inframarginal scutes on each of the bridges between the plastron and carapace. Adults grow to an average weight of about 200 pounds and an average length of 3 feet. The species feeds on mollusks, crustaceans, fish, and other marine animals. The loggerhead is widely distributed within its range. It may be found hundreds of miles out to sea, as well as in inshore areas such as bays, lagoons, salt marshes, creeks, ship channels, and the mouths of large rivers. Nesting occurs mainly on open beaches or along narrow bays having suitable sand, and it is often in association with other species of sea turtles. Most loggerhead hatchlings originating from U.S. beaches are believed to lead a pelagic existence in

the North Atlantic gyre for an extended period of time, perhaps as long as 7 to 12 years, and are best known from the eastern Atlantic near the Azores and Madeira. Post-hatchlings have been found floating at sea in association with Sargassum rafts. Once they reach a certain size, these juvenile loggerheads begin recruiting to coastal areas in the western Atlantic where they become benthic feeders in lagoons, estuaries, bays, river mouths, and shallow coastal waters. These juveniles occupy coastal feeding grounds for about 13 to 20 years before maturing and making their first reproductive migration, the females returning to their natal beach to nest.

This species is the second-most common sea turtle to occur in Rhode Island waters, where it is found sparingly during late summer during late summer. Threats include loss or degradation of nesting habitat from coastal development and beach armoring; disorientation of hatchlings by beachfront lighting; nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; watercraft strikes; disease; and incidental take from channel dredging and commercial trawling, longline, and gill net fisheries. There is concern about the extensive incidental take of juvenile loggerheads in the eastern Atlantic by longline fishing vessels from several countries.

Atlantic Green Turtle (*Chelonia mydas mydas)*; ESA Threatened; State Species of Concern

The green sea turtle grows to a maximum size of about 4 feet and a weight of 440 pounds. It has a heart-shaped shell, small head, and single-clawed flippers. Color is variable. Hatchlings generally have a black carapace, white plastron, and white margins on the shell and limbs. The adult carapace is smooth, keelless, and light to dark brown with dark mottling; the plastron is whitish to light yellow. Adult heads are light brown with yellow markings. Identifying characteristics include four pairs of costal scutes, none of which borders the nuchal scute, and only one pair of prefrontal scales between the eyes. Hatchling green turtles eat a variety of plants and animals, but adults feed almost exclusively on seagrasses and marine algae. Green turtles are generally found in shallow waters (except when migrating) inside reefs, bays, and inlets. The turtles are attracted to lagoons and shoals with an abundance of marine grass and algae. Open beaches with a sloping platform and minimal disturbance are required for nesting. Green turtles have strong nesting site fidelity and often make long distance migrations between feeding grounds and nesting beaches. Hatchlings have been observed to seek refuge and food in Sargassum rafts. The nesting season varies with the locality. In the southeastern U.S., it is roughly June through September. Nesting occurs nocturnally at 2, 3, or 4-year intervals. Only occasionally do females produce clutches in successive years.

This species rarely strays into Rhode Island waters. Threats include fishing and harvesting aquatic resources; bycatch; temperature extremes. A major factor contributing to the green turtle's decline worldwide is commercial harvest for eggs and meat. Fibro papillomatosis, a disease of sea turtles characterized by the development of multiple tumors on the skin and internal organs, is also a mortality factor and has seriously affected green turtle populations in Florida, Hawaii, and other parts of the world. The tumors interfere with swimming, eating, breathing, vision, and reproduction, and turtles with heavy tumor burdens may become severely debilitated and die. Other threats include loss or degradation of nesting habitat from coastal development and beach armoring; disorientation of hatchlings by beachfront lighting; nest predation by native and non-native predators; degradation of foraging habitat; marine pollution

and debris; watercraft strikes; and incidental take from channel dredging and commercial fishing operations.

Fish/Sharks:

Atlantic Salmon (*Salmo salar);* ESA Endangered; State Species of Concern

Atlantic salmon have a spindle-like body shape, rounded, broad in the middle, and tapered at each end. The shape is somewhat flattened toward the sides, which is typical of salmon species. The head is relatively small, about one-fifth of the body length. The underside paired fins are prominent, especially on juveniles. Spawning adults darken to a bronze color after entering freshwater and darken further after they spawn. Their silver color returns after they re-enter the sea. Atlantic salmon are anadromous – they leave the ocean to return to freshwater streams and rivers to breed. Atlantic salmon growth rates are variable and depend on several factors including season, habitat quality, age, sex, and population density. They grow much faster in saltwater than in freshwater. After 2 years at sea, adult salmon can grow to an average length of 28 to 30 inches and weight of 8 to 12 pounds. Unlike the Pacific salmon species, Atlantic salmon do not die after spawning, and adults can repeat the breeding cycle, living for 4 to 6 years. Juvenile Atlantic salmon mostly prey on invertebrates and terrestrial insects while in freshwater and on amphipods (small, shrimp-like crustaceans), krill, and fishes while at sea. Larger adult Atlantic salmon mainly prey on fish such as Atlantic herring, alewife, rainbow smelt, capelin, mummichogs, sand lances, flatfish, and small Atlantic mackerel. Birds, marine mammals, and fish prey on Atlantic salmon.

Atlantic salmon populations are exposed to a variety of threats. The most significant threats to their survival include impediments—such as dams and culverts—that block their access to quality habitat, ongoing subsistence fisheries off the shores of Greenland, and changing conditions at sea. Salmon also face many other threats that affect their survival, such as poor water quality, degraded freshwater habitats from land use practices, disease, predation from introduced and invasive species, and interbreeding with escaped fish raised on farms for commercial aquaculture.

Atlantic Sturgeon (*Acipenser oxyrinchus);* ESA Endangered; State Species of Concern

Atlantic sturgeon lives in rivers and coastal waters from Maine to Florida. Hatched in the freshwater of rivers, Atlantic sturgeon head out to sea as juveniles, and return to their birthplace to spawn, or lay eggs, when they reach adulthood. The Atlantic sturgeon has five rows of bony plates known as scutes that run along its body and a snout with four slender, soft tissue projections, called barbels, in front of its mouth. In addition, the tail is like a shark's where one side, or lobe, is larger than the other. Atlantic sturgeon are slow-growing and late-maturing and have been recorded to reach up to 14 feet in length and up to 60 years of age. They are bluish-black or olive brown dorsally (on their back) with paler sides and a white belly. Atlantic sturgeon are similar in appearance to shortnose sturgeon, but can be distinguished by their larger size, smaller mouth, different snout shape, and tail scute pattern. In rivers from Delaware to Canada, adults spawn in the spring and early summer. Because adult Atlantic sturgeon migrate along the coast when not spawning and tend to preferentially use estuaries, estuarine-oriented adults may appear to be preparing to spawn in the spring or fall but are just feeding.

The most significant threats to Atlantic sturgeon are unintended catch in some commercial fisheries, dams that block access to spawning areas, poor water quality (which harms development of sturgeon offspring), dredging of spawning areas, water withdrawals from rivers, and vessel strikes. Atlantic sturgeon are sometimes accidentally caught by fishermen trying to catch something else (bycatch). Atlantic sturgeon habitat can be disrupted or lost because of various human activities, such as dredging, dams, water withdrawals, saltwater intrusion (often caused by groundwater pumping from freshwater wells or drought), chemical contamination of sediments in rearing areas, and other development. Sturgeon need hard bottom substrates in freshwater reaches for spawning, so any activity that destroys those locations directly (e.g., dredging) or indirectly (e.g., sedimentation or saltwater intrusion) would affect Atlantic sturgeon habitat. To support all life stages, Atlantic sturgeon also require sufficient water quantities and water qualities to support all life stages, which are often impacted by the activities above. Atlantic sturgeon can be struck by the blades of a propeller as a boat is passing or struck by the boat itself. The risk of injury and mortality can be high in areas with high ship traffic.

Giant Manta Ray *(Manta birostris);* ESA Threatened

The giant manta ray is the world's largest ray with a wingspan of up to 29 feet. Manta rays are recognized by their large diamond-shaped body with elongated wing-like pectoral fins, ventrally placed gill slits, laterally placed eyes, and wide terminal mouths. In front of the mouth, they have two structures called cephalic lobes which extend and help to introduce water into the mouth for feeding activities (making them the only vertebrate animals with three paired appendages).

Giant manta rays are slow-growing, migratory animals with small, highly fragmented populations. The giant manta ray can be found worldwide in tropical, subtropical, and temperate bodies of water and is commonly found offshore, in oceanic waters, and near productive coastlines. The timing of these visits varies by region and seems to correspond with the movement of zooplankton, current circulation and tidal patterns, seasonal upwelling, seawater temperature, and possibly mating behavior. The species has also been observed in estuarine waters near oceanic inlets, with use of these waters as potential nursery grounds.

The main threat to the giant manta ray is commercial fishing, with the species both targeted and caught as bycatch in several global fisheries throughout its range. Manta rays are particularly valued for their gill rakers, which are traded internationally. In 2018, NMFS listed the species as threatened under the Endangered Species Act. Overall, given their life history traits, particularly their low reproductive output, giant manta ray populations are inherently vulnerable to depletions, with low likelihood of recovery.

Shortnose Sturgeon (*Acipenser brevirostrum);* ESA Endangered

Shortnose sturgeon can grow to approximately 4.5 feet long and weigh up to 60 pounds. They are yellowish-brown and generally have a black head, back, and sides. Their bellies are white to yellow. They have five major rows of scutes and a protruding snout with four barbels (fleshy, whisker-like projections). Shortnose sturgeon are similar in appearance to Atlantic sturgeon, but can be distinguished by their smaller size, larger mouth, smaller snout shape, and tail scute pattern. Shortnose sturgeon live in rivers and coastal waters from Canada to Florida. They hatch in the freshwater of rivers and spend most of their time in the estuaries of these rivers. Unlike

Atlantic sturgeon, shortnose sturgeon tend to spend relatively little time in the ocean, staying close to the shore if they do enter the ocean. In the spring, adults move far upstream to spawn. After spawning, the adults move rapidly back downstream to the estuaries, where they feed, rest, and spend most of their time.

The historical range of shortnose sturgeon included major estuaries (areas where rivers meet the sea) and river systems from Canada to Florida. While the shortnose sturgeon were rarely the target of a commercial fishery, they were often taken incidentally in the commercial fishery for Atlantic sturgeon. Currently, shortnose sturgeon are found in 41 rivers and bays along the East Coast, spawning in 19 of those rivers and comprising three "metapopulations," or reproductively isolated groups. These three metapopulations include the Carolinian Province (southern metapopulation), Virginian Province (mid-Atlantic metapopulation), and Acadian Province (northern metapopulation). The most significant threats to the species are dams that block access to spawning areas or lower parts of rivers, poor water quality, dredging, water withdrawals from rivers, and unintended catch in some commercial fisheries.

Oceanic Whitetip Shark (*Carcharhinus longimanus);* ESA Threatened

Oceanic whitetip sharks have a distinctive pattern of mottled white markings on the tips of their dorsal, pectoral, and tail fins. These markings are why they are called "whitetip" sharks. They are large and have stocky builds. Their dorsal fins are rounded and their pectoral fins are long and paddle-like. The color of their bodies depends on where they live but generally, they are grayish bronze to brown, while their undersides are whitish with some individuals having a yellow tinge. The oceanic whitetip shark is considered a top predator. They are opportunistic, feeding primarily on bony fishes and cephalopods, such as squid. However, they also reportedly feed on large pelagic sportfish (e.g., tuna, marlin), sea birds, other sharks and rays, marine mammals, and even garbage.

Oceanic whitetip sharks are found in tropical and subtropical oceans throughout the world. Oceanic whitetip sharks are long-lived, late maturing, and have low to moderate productivity. It is a pelagic species, generally remaining offshore in the open ocean, on the outer continental shelf, or around oceanic islands in water depths greater than 600 feet. They live from the surface of the water to at least 498 feet deep. Oceanic whitetip sharks have a strong preference for the surface mixed layer in warm waters above 20°C and are therefore a surface-dwelling shark.

Bycatch in commercial fisheries combined with the rise in demand for shark fins is threatening oceanic whitetip sharks. They are frequently caught in pelagic longline, purse seine, and gillnet fisheries worldwide and their fins are highly valued in the international trade for shark products. Their populations have declined as a result. In 2018, NMFS listed the species as threatened under the Endangered Species Act.

Birds/Migratory Birds:

Narragansett Bay and its associated habitats provide foraging, nesting, and resting habitat for a variety of bird species. Among the more frequent and abundant guilds are waterfowl (geese and ducks); shorebirds (e.g., plovers and sandpipers); wading birds (e.g., herons and egrets); raptors, gulls, and terns; and songbirds.

ESA Protected Species:

Roseate Tern (*Sterna dougallii);* ESA Endangered; State Species of Concern

The roseate tern is a medium-sized, gull-like tern about 15 inches long. When not in breeding season (late April to early September), it has a black bill, black legs, white forehead and most of the crown, and a long, deeply forked tail. During this time, the roseate tern is often difficult to distinguish from common terns, among which it nests in the Northeast. During breeding season, it is paler than other terns, with most of its plumage turning silver-gray above and creamy white below a rosy-pink chest and a black cap. It also develops long white tail-streamers that it loses after the breeding season. In the northeastern birds, the black bill becomes orange-red at the base and the black legs also turn orange-red. The roseate tern is a seabird that is mainly found in the Northern Hemisphere on the northeastern coast of North America, extending from Nova Scotia to the southern tip of Florida. The roseate tern is divided into four subspecies and the North American subspecies is divided into two separate breeding populations: one in the northeastern U.S. and Nova Scotia and another in the southeastern U.S. and Caribbean. Roseate terns are most common in the central portion of this range, from Massachusetts to Long Island, N.Y. The roseate tern is a specialist feeder eating almost exclusively small fish, primarily the American sand lance in northeastern populations. Roseate terns' nest on small barrier islands, often at ends or breaks. They nest in hollows or under dense vegetation, debris or rocks hidden from predators. Roseate terns in northeastern North America almost always nest in colonies with common terns.

Habitat has been greatly reduced by human activity and development on barrier islands, predation, and competition from expanding numbers of large gulls. Roseate terns are highly sensitive to disturbances and will desert a whole colony (including their eggs) if they feel threatened. The move to less desirable, often inadequate areas exposes the roseate tern to high predation and affects its ability to reproduce. Predatory birds, such as the great-horned owl and black-crowned night heron, pose a greater threat because they can fly to the more protected island nesting sites. An increase in great-blacked gull and herring populations has displaced roseate terns from their traditional nesting colonies in the Northeast. Roseate terns compete with gulls for nesting sites and food; the aggressiveness and larger size of the gulls give them an advantage. Gulls also compete for habitat with terns by nesting before the terns do, leading the roseate terns to retreat and abandon their historical sites. The loss of habitat from erosion, a possible result of rising sea levels, is another major factor contributing to the decline of roseate tern populations.

MBTA Birds of Concern:

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures as outlined by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act.

The birds listed below are birds of concern either because they occur on the US Fish & Wildlife Service (USFWS) Birds of Conservation Concern (BCC) list or warrant special attention during project activities in the Narragansett Bay area. The attached list is not guaranteed to include every bird that may be found in the area.

Table 3.4: USFWS Birds of Conservation Concern for Narragansett Bay Area; https://ecos.fws.gov/ipac/location/Z3HCK67CTZBDTA234Q4VZBBSG4/resources

· American Oystercatcher · Bald Eagle · Black Scoter · Black Skimmer · Black-billed Cuckoo · Bobolink · Bonaparte's Gull · Buff-breasted Sandpiper · Canada Warbler · Clapper Rail · Common Eider · Common Loon	· Common Tern · Double-breasted Cormorant · Dunlin · Great Black-backed Gull · Herring Gull · Least Tern · Lesser Yellowlegs · Northern Gannet · Prairie Warbler · Purple Sandpiper · Razorbill · Red-breasted Merganser	· Red-throated Loon · Ring-billed Gull · Ruddy Turnstone · Seaside Sparrow · Semipalmated Sandpiper · Short-billed Dowitcher · Snowy Owl · Surf Scoter · Whimbrel · White-winged Scoter · Willet · Wood Thrush

Marine Mammals:

The USFWS and National Marine Fisheries Service (NMFS) have jurisdiction over marine mammals protected under the Marine Mammal Protection Act (MMPA) that may be present in the existing NBNERR and the proposed expansion area. Among the marine mammals that are found in Narragansett Bay, the harbor seal is the only regular, abundant species. Other than harbor seals, Narragansett Bay is not commonly frequented by marine mammals but Table 3.5 details the MMPA protected species found in the 'New England/Mid-Atlantic" region as defined by NOAA. ESA listed species have their status (Threatened or Endangered) included, as well.

Table 3.5: Marine Mammals in Mid-Atlantic/New England; NOAA Fisheries Marine Mammals

Dolphins:	**Whales:**	**Seals/Sea Lions:**
· White Beaked: (*Lagenorhynchus albirostris)* · Striped: *(Stenella coeruleoalba)* · Spinner: (*Stenella longirostris)* · Short-beaked Common (*Delphinus delphis)* · Rough-Toothed (*Steno bredanensis)* · Risso's (*Grampus griseus)* · Atlantic Spotted (*Stenella frontalis)* · Atlantic White-Sided (*Lagenorhynchus acutus)* · Clymene (*Stenella clymene)* · Common Bottlenose (*Tursiops truncatus)* · Harbor Porpoise (*Phocoena phocoena)* · Pantropical Spotted (*Stenella attenuata)*	· True's Beaked Whale: (*Mesoplodon mirus)* · Sperm: (*Physeter macrocephalus);* ESA Endangered · Sowerby's Beaked (*Mesoplodon bidens)* · Short-Finned Pilot: (*Globicephala macrorhynchus)* · Sei (*Balaenoptera borealis);* ESA Endangered · Pygmy Sperm (*Kogia breviceps)* · Blainville's Bleaked (*Mesoplodon densirostris)* · Blue (*Balaenoptera musculus);* ESA Endangered · Bryde's (*Balaenoptera edeni)* · Cuvier's Beaked Whale (*Ziphius cavirostris)* · Dwarf Sperm (*Kogia sima)* · Fin (*Balaenoptera physalus);* ESA Endangered · Gervais' Beaked (*Mesoplodon europaeus)* · Humpback (*Megaptera novaeangliae)* · Killer Whale (*Orcinus orca)* · Long-Finned Pilot (*Globicephala melas)* · Melon-Headed (*Peponocephala electra)* · Minke (*Balaenoptera acutorostrata)* · North Atlantic Right Whale (*Eubalaena glacialis);* ESA Endangered · Northern Bottlenose Whale (*Hyperoodon ampullatus)* · Pygmy Killer Whale (*Feresa attenuata)*	· Gray Seal (*Halichoerus grypus atlantica)* · Harbor Seal (*Phoca vitulina)* · Harp Seal (*Pagophilus groenlandicus)* · Hooded Seal (*Cystophora cristata)*

State Species of Concern; RIDEM, 2015 Listing of Rhode Island Species of Greatest Concern

The Rhode Island Department of Environmental Management is responsible for approving lists of plant and animal species that are of conservation interest in Rhode Island. RIDEM, University of Rhode Island, The Nature Conservancy, and the RINHS assist RIDEM by gathering and

reviewing data on species occurrences in the state and region and listing species of likely conservation interest in Rhode Island. The above RIDEM resource indicates (as of 2015) there are 454 total species of greatest concern: 21 mammals, 123 birds, 23 herpetofauna, 45 fish, and 242 invertebrates. The corresponding information (with links) below detail specific species distribution, descriptions, and potential threats for the species of concern. State species of concern that are also ESA listed have been included in the preceding paragraphs of section 3.2.4.

Mammals

Rhode Island is home to hundreds of species of mammals with 21 total species being listed as Species of Greatest Concern. The most common species include the white-tailed deer, coyote, skunks, foxes, squirrels, raccoons, weasels, and bats, among others. Statewide monitoring of hunting of game species provides data that assists in state calculations of population sizes. These estimates help prioritize future conservation management activities. Of the species of concern, a large portion are bats (including the federally listed Long Eared Bat) which are often heavily affected by commercial and residential developments of their natural habitat. Other common mammals include whales, the harbor seal, and harbor porpoise. These aquatic species are often heavily impacted by commercial activities such as shipping and fishing. The remaining mammals listed are terrestrial and share common threats such as competition with invasive species and human modifications of natural habitat (RIDEM Mammals).

Herpetofauna

Salamanders, frogs, toads, turtles, and snakes are common throughout Rhode Island. Common amphibian and reptile habitat are vernal pools. Vernal pools are seasonally dependent ponds that occur at lower points on the ground and do not exist year-round. These pools are used for breeding. Vernal pools are susceptible to land development pressures especially due to their shifting existence. Surveys during one part of the year may not observe these crucial habitats. Other species seek protection beneath logs and branches, where they find insects or other food sources. Reptiles and amphibians are also known to eat berries, grasses, flowers, or even small mammals and birds. Twenty-three reptiles and amphibians are considered “species of concern” in Rhode Island, meaning that populations are low or habitat is threatened. Among these species are reptiles such as the eastern box turtle, the eastern hognose snake, and the eastern ribbon snake; and amphibians such as the eastern spadefoot toad and the red spotted newt. Threats to these species include urban development, invasives, impacts from dams, and sewage (RIDEM Herpetofauna).

Fish

The waters of the NBNERR are filled with hundreds of species of fish, both pelagic and benthic. Many of those species help support economically important fisheries in the region, and other species play important roles in the bay’s food web so stewardship is incredibly important. Along with the ESA listed species detailed above, many more species are considered of great concern to the state of Rhode Island. In addition, many species of fish are considered anadromous, which means that they live out most of their lives in the ocean, but swim inland when it comes time to spawn. Rhode Island’s 500+ dams make this transition difficult for many species but the reserve designated areas do not have any dams. For example, the federally listed Atlantic sturgeon has

been drastically affected by this network of dams. Other impacts to state listed fish include overfishing, eutrophication and chemical offloading, and temperature fluctuations due to climate change (RIDEM Fish).

Birds

There are hundreds of bird species in Rhode Island, both nesting and migratory. These species live in many different types of habitat including deciduous woodlands, marshland, coastal areas, and shrubby areas, among others. Shrubland and early successional woodland birds are among the most threatened throughout the state and throughout New England, as these habitat types continue to decrease. The northern bobwhite, American woodcock, willow flycatcher, blue-winged warbler, prairie warbler, and eastern towhee are some of the at-risk species that live in those habitats. Woodpeckers, warblers, and owls are also common. Common beach and estuarine birds include terns, sandpipers, herons, and waterfowl. There are over one hundred bird species of greatest concern so their protection is highly relevant when considering reserve actions. Threats to birds include invasive species, and human disruption through development of habitat, commercial activities, and recreational use of resources (RIDEM Birds).

Invertebrates

Thousands of species of invertebrates are expected to exist in Rhode Island, but only about 500 species have been recorded in Rhode Island's Natural Heritage Database. There are 242 species of greatest concern so specific species cannot all be listed but among the state species of concern include many tiger beetles, and lepidoptera (moths and butterflies) species that have been previously recorded in the reserve. Invertebrates can be great environmental indicators. For example, the presence of mayflies indicates good water quality due to the species' intolerance of low dissolved oxygen levels. Invertebrates can also be sensitive to changes in temperature, competitors, ground cover, or any number of environmental factors (RIDEM Invertebrates).

3.3 Cultural and Historic Resources

History

The Reserve's setting is predominantly natural or rural, in contrast to much of coastal mainland Rhode Island, which is generally heavily developed. Patience, Hope, and Dyer islands are completely uninhabited while Prudence is still mostly undeveloped, but small clusters of residential housing and other limited development exist. The year-round human population on Prudence Island is approximately 150 people, although it grows to nearly 2,000 people at times during the summer. Prudence Island lacks many amenities, although one small year-round and one summer general store is available, as is an island post office. Transportation to the NBNERR is by private boat or by the Prudence Island auto and passenger ferry, which makes multiple daily round trips between Bristol, R.I., and Homestead on Prudence Island. All visitors to the Reserve are encouraged to provide their own ground transportation while on Prudence Island.

Narragansett Bay has long been central to the region's history. Native peoples previously used the bay and reserve for fishing and hunting. After the arrival of European colonizers, the bay continued to be beneficial to their society, increasing commerce, communication, and

transportation. Most Bay islands were purchased from Native American residents, and then renamed by Roger Williams, who assisted in the acquisition. The middle of Prudence Island became a summer colony for wealthy residents in the mid-1800s. This was followed by the development of more modest homes along the eastern shore. Most of the islands were cleared and farmed well into the 19th and early 20th centuries. Patience Island has eluded most development due to a combination of poor access, poor soils, and lack of water. Hope Island is unsuitable for development. Prudence Island has had a long history of predominantly seasonal use, with a human population that has fluctuated considerably. The location of Prudence Island near the center of Narragansett Bay made the island a desirable central location during periods when water travel was prevalent. This region was heavily forested prior to European settlement, and the forest was believed to be highly dynamic due to the influence of natural disturbance, changing climate conditions, and the activities of American Indians. The use of fire to remove understory vegetation, a common practice of the Indians in this region, resulted in open forests. Recent investigations of regional land-use history suggest that open-land habitats in pre-European uplands were more uncommon than previously believed; natural and human disturbance was infrequent and generally local to Indian settlements.

The colonial influence on the New England landscape is visible today in the form of stone walls, foundations, and forest composition. Forest was cleared for agriculture, pasture, timber and cordwood. Coastal and river systems supported the largest population centers. Prior to the Revolutionary War, forests were cleared, drainage of coastal and inland wetlands occurred, which altered the hydrology of the region. The current forests are dissimilar to the forests that existed prior to European settlement, in the form of loss of previously dominant or common species. In the mid-to-late 1800s local farming became more unprofitable and so Prudence Island was abandoned as farmland. The abandonment of large tracts of land on the island created a patchwork of multi-stage vegetation as each parcel was gradually reclaimed by grassland and woody species. When the first colonists arrived, a mature growth forest of mixed hardwoods and conifers covered Prudence Island. Wild game and fish were plentiful, as was potable water. The soil types would have supported the farming practices of the time. The location of the island in the middle of Narragansett Bay was beneficial in terms of climate and ease of travel. Settlers cleared land, pastured their animals, and grew some crops including corn, wheat, and rye. Although the activities of these early settlers had some impact, they occupied only a small part of Prudence Island, and their impact was likely to have been minimal. The first regular ferry service to the island was established in 1742, increasing accessibility and attractiveness of Prudence Island. The island supported at least three grinding mills during the colonial era. The seasonal population peak was around 2,500 to 3,000.

The Revolutionary War had a devastating social and ecological impact on Prudence Island. The island was raided on multiple occasions and abandoned for a five-year period. British troops burned nearly all buildings on the island between 1776 and 1778, cut down all the remaining trees on the island for firewood, and confiscated or destroyed everything of value they could find. Many prewar residents never returned. By the mid-19th century there were about 12 farms operating on the island. A typical farm on Prudence Island during the mid-19th century would have kept a small number of horses, several oxen, some milk cows, a few pigs, and a larger number of sheep (probably more than 50) and produced corn, oats, barley, rye, potatoes, and large amounts of hay. In addition, butter, milk, wool, and market vegetables would likely have been produced. The turf (and topsoil) removal, coupled with the wind erosion that followed, left

large areas in the center and extreme south end of the island nearly devoid of vegetation. Summer visitation to the island by vacationers increased leading to an increase in land values and further subdivision of properties. Prudence Park, the island's first summer resort, was established on the west side of Prudence in 1875. A large wharf was built to accommodate regular steamboat stops from a scheduled service that ran between Providence and Newport. The development of the eastern shore was facilitated by the establishment of a ferry service between Prudence Island and Bristol in 1904. By 1910, a dock had been built at Homestead (the site of the current ferry landing along the eastern shore). There were only three working farms on the island and fewer full-time residents than at any time in the previous 150 years. Many island residents made their living on the Bay (e.g., shellfishing, lobstering) and often supplemented their income by providing support services for the summer residents, such as carpentry or retail merchandising via the grocery/sundry stores that operated seasonally on the island.

By 1946, there were 300 cottages and 1,500 seasonal residents on Prudence Island. The establishment of Prudence Island as a summer resort community and tourist destination can be linked to the abandonment of agriculture across most of the island, freeing large tracts of land for residential development and altering the vegetation composition of the island. In 1959, the Baker Farm property was preserved under the ownership of the Rhode Island Heritage Foundation. In the era of conservation that has followed, approximately 70 percent of Prudence Island has been preserved or protected from development. As the tourism industry was developing, Prudence Island had boasted several service and entertainment facilities (e.g., stores, farm stands, bakeries, casinos, dance halls, and yacht clubs). Two hurricanes were responsible for the destruction of many of these facilities. Fire was responsible for destroying others. Support services generally emphasize low-impact, outdoor recreational use of the land. The greatest manipulations of these properties during that time were the construction and maintenance of hiking trails and campsites. With the establishment of the NBNERR (which manages the former estuarine sanctuary, former Navy lands, and former Rhode Island Heritage Foundation properties, among others) and the Prudence Conservancy, the emphasis on low-impact recreation will continue (NB NERR Site Profile Pg. 15).

The greatest human land-use impact on Prudence Island occurred during historic times. The impact of European settlement was significant, occurring within a very limited time frame. Mature growth forests on Prudence Island were completely removed within a scant 150-year period and the land-use practices that followed were intensive, preventing the development of successive communities for an additional 100 years. This extensive manipulation directly impacted animal communities and continues to affect the island's ecology.

Cultural Resources

The first evidence of post-glacial human occupation in the Narragansett Bay watershed is located on Conanicut Island and dates back roughly 5,000 years. Privately held artifact collections from Prudence Island representing various arrow point styles support this suggestion. Two Algonquin tribes, the Narragansetts of the West Bay and the Wampanoags of the East Bay, subsisted off of the resources within and surrounding the Bay. Natives numbered approximately 8,000 in total. A prehistoric survey of Prudence and Patience islands conducted in 1981 identified numerous seasonal campsites where shellfish processing, stone tool manufacturing, and cooking were evident, but also found no strong evidence that permanent, large prehistoric settlements existed

on either island. Prudence and Patience islands existed on the eastern edge of the Narragansett Indian territory but appeared to be peripheral to their main area of activity. The Wampanoag tribe, with a territory predominantly east of the Bay, may have inhabited many islands in the Bay prior to the Narragansett tribe expansion into this area. Both tribes claimed ownership of Prudence Island during the early colonial period. However, from an ecological perspective, influences of native peoples were relatively minor and the precolonial environment is thus generally considered to be the natural background condition. Due to poor soils and inaccessibility, the majority of the NBNERR has been undeveloped. As such, there are few areas of cultural significance on the islands. The smaller islands in Narragansett Bay (Hope, Dyer, and Patience) have eluded development. The islands were cleared and farmed well into the 19th and early 20th centuries. Archaeologically significant traces of this agrarian society remain. A notable historical use of the Bay, though, was its use for the US Navy (NB NERR Site Profile Pg. 15).

The addition of the Little property would allow for the further protection of historical resources on Prudence Island. Known historical sites in the expansion area include the Thomas Allin home site and the accepted site of Pulpit Rock, both located in the northeast portion of the property. Also included in the Little property are 16th-century stone walls, a gristmill, and a rifle pump. The sections below detail other historical sites on Prudence Island that have benefitted from conservation.

Prudence Island Historical Sites (NB NERR Trail and Sites Map)

North End Farm Sites: The site consists of a large house foundation and cellar, an ice cellar, and the cellars and foundations of at least six barns or outbuildings, clustered on approximately 3 acres of the former 270-acre farm. The site and structural remains are in good condition with little subsurface disturbance. The area surrounding the cluster of foundations consists of several acres of open land formerly fenced fields which extended south to Potter's Cove, now covered with overgrowth. North End Farm was probably developed during the period of rebuilding after the Revolution. Providence merchants John Brown and Thomas P. Ives purchased the property for a tenant farm in 1807. The farm remained in family ownership until the early twentieth century.

Baker Farm Site: The Baker Farm dates to the 17th century but after the British burned down the standing structures on the island, the farm was rebuilt. Charles Potter bought and maintained the farm for 30 years post-Civil War. In 1894 the Prudence Inn was built to house growing summer populations and served as a boarding house until the 1920's.

Prudence Schoolhouse: Built in 1896 by Captain Halsey Chase, the Prudence Island School is the last functional one-room schoolhouse in Rhode Island. It was the fourth schoolhouse built on Prudence Island, replacing one that used to stand north of the Baker Farm site. The school was closed from 1981-1989 but has otherwise remained active for over 100 years. The addition containing bathrooms and a kitchen was built in 1954, and a small room was added to that in the 1990s. The non-profit Prudence Island School Foundation leases the building to teach island children in the early grades. The bell, earlier a fog bell at the steamboat wharf depot, came originally from the Davol Mill in Providence.

Figure 3.6: Prudence Island Schoolhouse (https://prudenceislandschool.org/)

Prudence Naval Base: In 1942, the south end (now NBNERR lands) became a U.S. Navy ammunition depot. It was subsequently reduced to caretaker status in 1946 and re-opened for the Korean War, staying open until the 1970s. The property was given to the state in 1980 and was eventually made part of the NBNERR. The naval presence helped create disturbance-based habitats and certain naval structures still stand including multiple bunkers.

Prudence Park (Stone Wharf): The wharf at this site dates to the establishment of a summer resort community, Prudence Park, in 1875. Regular steamships operated from Providence to Prudence Island. It was soon a service operated from Providence to Newport until 1918, and the lure of escaping the summer heat of the city brought many people to the resort village, complete with inns, a casino, gas streetlights and a bathing pavilion.

Division Rock/Wall: The dividing point between the north and south halves of the island by acreage as decided by Roger Williams and Governor John Winthrop of the Massachusetts Bay Colony. Williams owned the northern half of Prudence Island between 1637 and 1639. Later that century, Division Wall was built to mark this division. The wall travels easterly across most of the island, ending at Governor Paine Road.

Prudence Island Light (Sandy Point Light): Built on Goat Island in Newport Harbor by David Melville in 1823, then moved to Sandy Point in 1851. It is the oldest existing lighthouse in Rhode Island. Five people died here during the Hurricane of 1938 when the lighthouse keeper's house was washed away in the tidal surge. In 2002, the U.S. Coast Guard granted a license to the Prudence Conservancy to maintain the lighthouse tower.

Figure 3.7: Prudence Island Lighthouse (https://www.nelights.com/exploring/rhode_island/)

The Prudence Island Historical and Preservation Society (PIHPS) has worked with both local and state organizations to further the preservation of island history and its place in the history of RI. Notably, the PIHPS provides NBNERR with island artifacts for display in its headquarters at the southern end of the island. PIHPS also lists these sites as important historical sites on Prudence Island (PIHPS Map and Site Information) in addition to the ones listed above.

Bullock's Wharf: Built in the mid-1850s by William P. Bullock, the Providence steamboats landed there until the steamboat wharf was built at Prudence Park in 1874. The wharf eventually fell into disrepair, and Daniel Arnold, the owner at the time, had it dismantled.

T-Wharf: The Navy built this pier when it established the base as an ammunition storage facility during World War II. The base closed in 1972 and eventually became part of the NBNERR. The wharf is now used for recreational and research purposes.

Prudence Conservancy Hiking Trails: Prudence Conservancy maintains several hiking trails that allow access to important historical and cultural sites on the island such as the Baker Farm.

Farnham Farm: The Farnham family farmed this property and raised dairy cattle here until the 1950s (except from about 1907 to 1928). In 1988, the Prudence Conservancy purchased 18 acres of the Farnham Farm (the rest had been sold to the state as open space). The farm now serves as a community center and offers educational and recreational programs for islanders. Sarah's Path was developed during the late 1890s, when Edward Farnham, built a multi-story addition on the farmhouse and planned to open a boarding house. The path was designed to link parts of the farm

and provide a pleasant stroll for visitors. It was lined with a variety of shrubs, trees, and flowering plants. The Prudence Conservancy has been working to restore the path.

Ice Pond (Named Shady Lake by the developers of Prudence Park): Farmers cut and stored ice from this pond for many years.

Steamboat Wharf: Built in 1874 by the developers of Prudence Park, the Providence and Newport steamboats stopped here for many years until 1918. A depot with the Prudence Island Post Office was located here for a period.

Stone Bridge on Atlantic Avenue: built in the late 1800s by the developers of Prudence Park; now closed to traffic.

Pavilion Site: Built on the beach in the late 1800s, the pavilion was located north of the steamboat wharf. It was an open square building with a paved floor and four stone pillars supporting a hip roof. It was destroyed in 1960 by a winter storm followed by Hurricane Donna that summer.

Pulpit Rock: This natural rock formation is found 200 feet in from the road southwest of Nag Pond. Roger Williams and Samuel Gorton probably preached to the natives here and it was potentially used as a throne by native tribes.

Portsmouth Historical Cemetery No. 41: The resting place for many of the island's early inhabitants, this cemetery is located less than .5 miles northwest of the Homestead ferry landing, near the intersection of Homestead and Alice Avenues. Some inscribed stones date back to the mid-1700s, with earlier burials marked by plain fieldstones. Some Island veterans of the Revolutionary War are buried here.

Indian Spring: This natural spring, enclosed by a circular concrete wall, is located west of the cemetery near Mill Creek. It was used by Native Americans and early settlers and as a source of water by nearby houses up through the early 1900s.

The Desert: An area of sandy soil located west of the Indian Spring. This was rich farmland in the Colonial era, but years of poor farming practices as well as winds stripped the fine topsoil and exposed the sand underneath. Mounds scattered around the center of the island are the result of this wind erosion when the dusty soil from the desert collects along objects such as stone walls, rocks, and tree stumps. A few mounds along the Division Trail are quite prominent.

Union Church: Built in 1927. Addition built in 1999 to hold Sunday school classes, and for a heated room to hold services in the winter months.

Our lady of Prudence Chapel: Built in 1925 for the growing Roman Catholic summer population.

3.4 Socioeconomic Resources

In reference to National Estuarine Research Reserves, socioeconomic resources mean the economic and social resources that may be impacted by reserve actions. Economic resources are, essentially, anything that goes into producing a good or service. More specifically, economic

resources can be agriculture, shipping, fisheries, tourism, or recreation, among many other potential businesses or industries. For example, the Narragansett Bay is an important shellfishery so actions taken on the reserve should account for impacts on the surrounding waters. Social resources refer to the specific details of the population that are affected by reserve actions. It is important to understand the social impacts of actions to ensure that people from a specific economic or racial background are not unfairly impacted by any reserve decision. In addition, other government agencies or the military may use nearby resources or land or have used the land and resources in the past.

3.4.1 Land Use

Agriculture

From the Colonial era to the present, agricultural practices have had a significant impact on the area. Coastal land along the upper Bay was extensively cleared for agriculture and lumber production during the 17th and 18th centuries. Agricultural use of the land on Prudence Island began with the establishment of multiple tenant farms on large continuous parcels during the colonial era, then changed to fewer, larger individual farms operated by a small number of tenants throughout the 19th century, and finally progressed to the abandonment of all but a few owner-operated farms by the start of the 20th century. Land clearing and agriculture have historically and presently affected the water column and benthic quality of the Narragansett Bay and its tributaries by contributing to nutrient loading and siltation. As agriculture grew less and less profitable, some island farmers took to growing Rhode Island bentgrass seed and for a period grew and sold turf as well. These activities were particularly detrimental to the ecology of certain parts of the island, causing near total loss of topsoil. The turf (and topsoil) removal, coupled with the wind erosion that followed, left large areas in the center and extreme south end of the island nearly devoid of vegetation (NB NERR Site Profile Pg. 19).

The overall decrease in soil productivity as the result of poor farming practices, combined with a reduction in profits due to a supply of cheap agricultural products from the Midwest, contributed to the abandonment of agriculture on Prudence Island. Another visible impact of the agricultural practices employed by these farmers is the presence of pine barrens, which owe their existence in part to poor agricultural practices, particularly the turf (or sod). Many of the vegetation complexes that are now present on Prudence Island can be directly linked to intensive human disturbance, it follows that continued human manipulations may be required to maintain these plant assemblages. Another legacy of past land-use practices is the abundance of invasive plants on Prudence Island. Historical land use has been linked to long-term changes in vegetation and environmental relationships, a shift in dominant species, and reduced community diversity (NB NERR Site Profile Pg. 21).

Presently, the little property is not being used for agricultural activities but idle agricultural land does exist. Absent any protections, there exists a possibility that the property could be used for agricultural purposes in the future.

Recreational Resources and Tourism

Access to Prudence Island is limited to one public ferry, and private boat mooring. No public transportation is available to Patience, Hope and Dyer islands. The ferry lands at Homestead on Prudence Island; public access is available at the T-wharf at the southern end of the island and a small floating dock located in Potter's Cove along the northeastern shore of the island. Increasing docking space for small vessels is a strategy for increasing access to the Reserve. Some drivable roads are maintained to allow access to certain habitats. Prudence Island's population reaches its peak in the summer where it will become as high as 3,000 people. Non-reserve recreational activities near the reserve include clamming, kayaking, hunting, fishing, hiking, boating, and birding. There is a network of trails throughout the island that provide space for hiking and mountain biking throughout the Reserve and the rest of the Island. The reserve has a large fishing pier and a sandy beach for public recreation. This access provides most people with opportunities to pursue activities such as walking, hiking, biking, birdwatching, clamming, fishing and just relaxing in many places around the Reserve. While public access to sensitive habits may be restricted, development of boardwalks or viewing platforms will provide additional access to sensitive habitats. Two of NBNERR's primary recreational activities include sportfishing and boating. Narragansett Bay is rich for sport fishing. Sportfish catches are striped bass, bluefish, winter flounder, and tautog. There are 50 private and 49 public boating facilities in the Bay and its tributaries, which offer recreational boating to the citizens of Rhode Island and neighboring states. Recreational boating is popular in all parts of the Bay. Newport, at the mouth of the Bay, is a center for international boating events (NB NERR Management Plan Pg. 75).

Another important recreational activity on the island is hunting, especially for white-tailed deer. Deer management zones have been established for harvesting deer in accordance with specific management goals for Rhode Island. The need to reduce auto strikes and address nuisance deer complaints are important deer management issues in addition to RIDEM's goal to preserve and maintain quality deer hunting for sportsmen. The only legal method of deer hunting on Prudence and Patience Islands is by archery, including crossbows. Proficiency testing is required for all archery deer hunters on Prudence and Patience Islands. Archery deer hunting is permitted at the Heritage Property from December 1 – 15. All deer taken must be reported to RIDEM within 24 hours using the harvest reporting website or be reported to an Environmental Police Officer as prescribed. The antlered deer (buck) bag limit is one. (Rhode Island Deer Hunting Regulations).

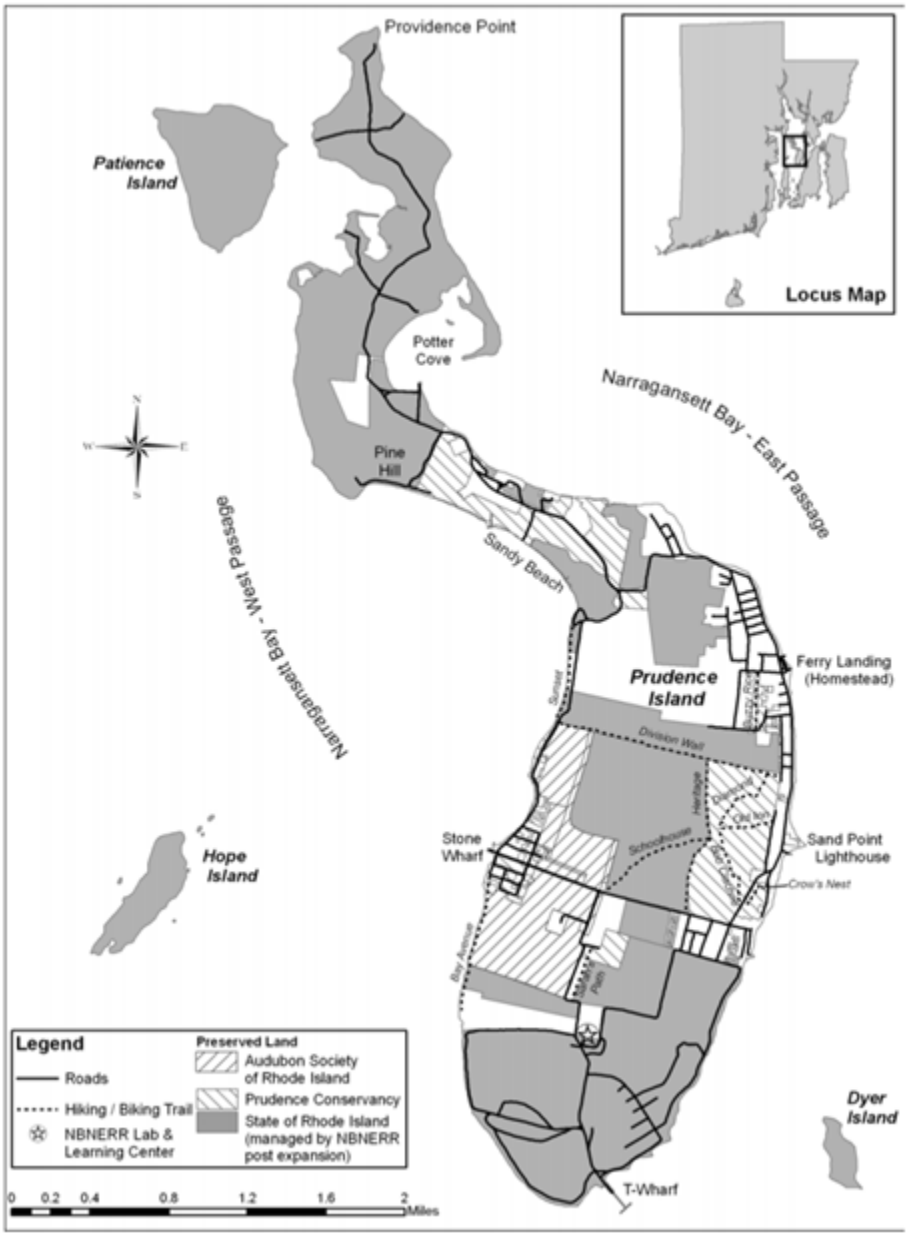

Figure 3.8: Hiking Trails of Prudence Island (NB NERR Management Plan, Pg. 76)

Along with those activities, people will often come to the island to specifically participate in the reserve's educational programs. Many outside organizations may also provide programs, such as walking tours, that encourage visits to the Island and reserve grounds. An example of this is the Audubon Society of Rhode Island which, through the reserve, provides families and individuals a long tour on Prudence Island learning about the ecological and cultural significance of the Reserve and our on-going research and monitoring projects. The Reserve works in partnership with several different organizations to provide marine science focused summer camps for students. Campers, in a reserve camp set up for kids, are provided with hands-on sampling and monitoring activities and have a chance to explore marine ecology as a career field. It's estimated that about 200 campers experience the Reserve each summer through sleepover and

day camps on Prudence Island. The Reserve hosts multiple community education events each year that offer different ways to interact and learn about living in a sustainable relationship with the reserve. These include festivals, fishing contests where anglers must follow legal size limits and catch regulations to compete for prizes, beach cleanups, and holiday celebrations put on by the reserve. Hands-on educational activities such as plankton labs, fish printing and squid dissections are conducted at the reserve lab with visiting family and formal education groups. The summer months are busiest for visitation at the Center. The Estuary Education Shed located on the T-Wharf houses two large flow-through aquaria, a touch tank, and several smaller coastal ecology exhibits. The T-wharf area is a popular island destination for both residents and visitors. The shed is also the starting point for a self-guided interpretive trail around the Reserve's South End unit. Save the Bay frequently brings K-12 students, educators, and campers to the Reserve on their boat, the M/V Aletta Morris (NB NERR Management Plan Pg. 37-38).

Due to the sensitivity of some habitats, activities such as camping, fires, motorized off-road vehicles, littering, and collection of any plant, animal, or artifact have been banned within the NBNERR. Restricted activities on the reserve include that vehicular access on Prudence Island is significantly restricted during the fall-winter deer hunting season. During this period vehicular access to the Reserve is restricted to a single road. Access to certain bird habitats is also discouraged during the breeding season. Many of the Reserve's bird rookeries are located on Patience, Hope, and Dyer Islands which are only accessible by private vessel. The Reserve is home to ecological habitats that are extremely sensitive to human disturbance, are rare and unique, or are home to threatened species. For public access purposes, the reserve will install viewing platforms, boardwalks, or informational signage to avoid harm to biological resources (NB NERR Management Plan Pg. 74).

The Little property is publicly accessible via roads and the existing trail system. Activities in the area are mostly low impact recreational uses such as hiking, biking, birding, and hunting. Human-related harmful impacts are always possible so extension of reserve policies regarding safe, sustainable land use is important. In addition, the designation of the expansion parcel would allow the reserve to use the land for educational programs

Commercial Resources

The islands of Narragansett Bay, with their numerous sheltered coves, provide excellent fishing and shellfishing resources. Finfish and shellfish fisheries have historically been major sources of sustenance and income for inhabitants of the Narragansett Bay watershed. Narragansett Bay was a rich fishing ground until the mid-1800s, when pelagic and anadromous fish stocks succumbed to the pressures of trap fishing and industrialization, respectively. Heavy, persistent fishing pressure and practices have, in part, caused many Bay stocks to dwindle, and the fin fishery has shifted primarily to coastal waters outside of the estuary. Commercial fishing practices have evolved from early gears, such as the small trap, handline, hand dredge and tong, and small surface net, to massive, modern, efficient, and potentially destructive gears. There is no commercial fin-fishing in the vicinity of the NBNERR, except for two commercial menhaden seining vessels. Today, the shellfishery is the most important commercial fishery in the Bay with the northern quahog being the most commercially important species. Other important fisheries include the American lobster and menhaden during specific seasons. Currently, approximately 8 million pounds of quahogs are extracted from Bay waters annually (NBEP.org). Overall, it is

estimated that shellfish biomass has dropped 17 percent since 1960 and 88 percent since 1898 (NB NERR Site Profile Pg. 125).

Historically important codfish, tautog, and alewife populations no longer support distinct commercial fisheries due to drastically reduced numbers. The abundance of the commercially important winter flounder has been in steady decline with the decline being evident throughout Narragansett Bay. Both direct and indirect harvesting pressures have been implicated as instrumental factors driving finfish and shellfish population shifts in Narragansett Bay. Fish trapping, which was the most highly utilized and effective harvesting method employed in early times, is thought to have affected target populations while otherwise minimally impacting the environment. However, efficient but destructive commercial fishing practices of the last century, especially scallop dredging and trawling, have greatly impacted benthic habitat, which in turn may have affected the recruitment of various commercial species, including the bay scallop. Currently, exotic shellfish diseases are impacting economically important species, such as the American oyster. A long history of persistent fishing has also affected Bay ecology through direct extraction and ascending and cascading trophic consequences (NB NERR Site Profile Pg. 132).

Sources of degradation and pollution are centered in and around industrial and residential growth centers, mostly in the upper Bay near the Providence and Fall River metropolitan areas, although effects are often widespread. Modifications to natural hydrologic systems have directly affected or facilitated environmental degradation throughout the Narragansett Bay watershed. As mill dams were constructed, they constricted water flow and fish passage on virtually all tributaries to the Bay, which has had numerous ecological effects, including the decimation of anadromous fish populations. By 1900, hundreds of Narragansett Bay watershed textile and metal mills were using Bay tributary waters for power, processing, and washing of materials, and for direct waste discharge. And, with the invention of the steam turbine, many industries replaced hydropower with more flexible fossil fuel power, which introduced various hydrocarbon-derived pollutants into the Bay system. Nutrient loading perhaps has the greatest immediate impact on Narragansett Bay ecology, having ascended trophic effects on all biota and direct effects on certain benthic species through oxygen depletion associated with eutrophication. Persistent pollutants, such as metals, synthetic organic compounds, and PHCs also enter the Bay through discharge and riverine sources (NB NERR Site Profile Pg. 159).

Another crucial commercial activity in the vicinity of the NERR is shipping. As early as the 1700s, Rhode Island ports were involved in a lucrative shipping trade of crops, slaves, and rum with Europe, South America, Africa, and the West Indies. By 1965, Providence was the fourth largest port in New England. Due to the sufficiently deep passages between islands, the Bay permits the navigation of large ships. Channel dredging is necessary at the mouth of Providence and Taunton Rivers. Major ports at the head of Narragansett Bay are Providence and East Providence and Fall River and Tiverton in Mount Hope Bay. Regular marine shipping continues with the present importation of fossil fuels and automobiles. As of 2005, approximately 13 million tons of cargo are imported into Narragansett Bay each year. Shipping has led to modifications of the shoreline, driven the dredging of deep-water channels, and introduced invasive marine species from foreign bilge water and bottom fouling. Aquatic nuisance species, introduced primarily through fouling and bilge exhaust associated with the shipping trades, have been affecting trophic dynamics since the 1800s (NB NERR Site Profile Pg. 149).

3.4.2 Population

Prudence, Patience, and Hope Islands sit within the town of Portsmouth, Newport County, RI. The current population of Portsmouth is reported at 17,510 (Neighborhood Scout). 93% of Portsmouth residents finished high school, 47.5% are college graduates, and 5.6% are currently attending college. Primary employment industries in the area are healthcare, professional, scientific, and technical services, education, and retail. Ethnic composition in the area is predominantly white (92%), followed by Hispanic/Latinx (3.4%), Asian and mixed race (both 1.8%), and black/African American (1%). Ancestry is primarily Irish (26.1%), English (19.8%), and Portuguese (14.4%). English is the primary language spoken (at 91.1%), with a few speakers of Spanish (2.7%), French (1.5%), and Slavic languages (1.1%).

The population of Rhode Island was growing faster than any other New England state. From 1860 and 1920, the population of Rhode Island tripled, and industrial employment doubled. During that period, immigrants came to America to labor on public works projects or in the textile mills and metals factories. Meanwhile, agriculture declined as the workforce shifted from fields to factories and urbanization began. As commerce and population grew with the industrialization and urbanization of the watershed so did the need for infrastructure, in the form of streets, dredged waterways, railroads, and urban sewage systems. In 1870 the city of Providence constructed a sewer system that conveyed the city's sewage through a series of 65 sewer outfalls directly into Providence's rivers and harbor. Processing of Providence sewage by chemical precipitation began in 1901 at Field's Point, but the plant was already inadequate to keep up with the growing population by 1910. The city then began dumping large quantities of precipitated sludge into Narragansett Bay, just east of Prudence Island, which continued until 1950. At present, the population of full-time residents is growing more rapidly than that of seasonal residents and many of the older cottages are being converted for year-round use. New home construction continues to be slow but constant. Access to Prudence Island is easier today than at any time before. Recent preservation efforts and the continued lack of on-island amenities would suggest that land use on Prudence Island is unlikely to change substantially in the future. While Rhode Island's overall population has not increased substantially in recent years, it has been redistributed through increased coastal development. Continued development and increases in sea level may dramatically increase this modification as local property owners seek to preserve their land. The Little property does not have any people living on it but development could occur if the increase in permanent residents continues to rise.

Environmental Justice

As described above, Prudence Island's population is incredibly small and the percentage of that population that is minority or low-income is even smaller. The addition of the Little parcel would not adversely affect any of the population, especially disproportionately. With the addition of the new piece of land, the reserve would increase its ability to provide important stewardship and educational programs. These programs would have beneficial impacts for all people regardless of background or race.

Economic Base

The islands of NBNERR are combined with Aquidneck Island to form the town of Portsmouth. Major industries on Aquidneck Island include advanced thermoplastic composites, IT, navigational equipment, oceanography, and underwater systems development. Marinas, shipbuilding, tourism, and farms are also integral to the local economy. Several interstates and nearby airports and train stations make Portsmouth easily accessible to visitors. Newport County is known for its aquatic resources, with its longstanding tradition of sailing as well as the deep water for docking larger vessels. The Little property is not home to any of the major industries listed above but designation of the land could help increase tourism for recreational activities.

3.4.3 Military

The U.S. military has occupied various key strategic areas within Narragansett Bay since 1775—mostly prominent coastal points and nearly every Bay island—to protect the security of the Bay's civilians as well as valuable resources. These outposts began as forts to house cannons and guns to stop penetration of Bay waters by enemy ships. Over time, the Navy developed numerous in-Bay sites as huge military ports, torpedo development facilities, shipbuilding operations, and naval air stations. Military operations modified coastal lands and shorelines as necessary to meet their changing needs. During the early and mid-1900s, the Navy developed at least 6,000 acres of coastal lands along 31 miles of the Narragansett Bay shoreline, which included the filling of at least 400 acres of the Bay to expand Quonset Point Air Station. Military waste, including hazardous pollutants, was routinely disposed of in coastal landfills and salt marshes, which at that time were generally considered valueless. Navy dumpsites are responsible for at least seven identified superfund sites in Rhode Island. The Navy also used the Bay waters extensively as a training ground and as a testing site for maritime weaponry, including torpedoes and mines, some of which remain on the seafloor.

In 1942, the federal government purchased approximately 625 acres at the south end of Prudence Island which became the site of a U.S. Navy ammunition dump. The alterations done to this property by the Navy were extensive during the construction of ammunition bunkers and firebreaks. The habitats present on this property today are completely different to the pre-Navy habitat types. The installation was downgraded to caretaker status in 1946, reopened during the Korean War, and remained an active ammunition storage facility until the early 1970s. In 1980, this property was given to the state of Rhode Island as part of the Federal Lands to Parks Program. Shortly after World War II, in 1950, the federal government announced plans to build an animal research laboratory near the center of Prudence Island at the site of the abandoned Baker Farm. Overwhelming public opposition caused that laboratory to be built elsewhere (NB NERR Site Profile Pg. 20).

Two major installations are in the state of Rhode Island, currently. These are the Quonset Point Air National Guard Station and Naval Station Newport. Facilities supporting the National Guard and navy also are found within Rhode Island (militarybases.us). However, there are no military activities underway in the reserve area and there is no military property within the parcel proposed for addition.

Chapter 4 Environmental Consequences

This chapter examines the anticipated environmental consequences for the two alternatives addressed in this Environmental Assessment. The environmental consequences would be applicable to the affected environment described in Chapter 3.

The determination of whether an effect (impact) of a proposed action is "significant" is based on criteria established in Council on Environmental Quality (CEQ) Guidance and NOAA standards and practice, including the "Policy and Procedures for Compliance with the National Environmental Policy Act and Related Authorities: Companion Manual for NOAA Administrative Order 216-6A" (NOAA, January 31, 2017). The term "effects" (which is synonymous with "impacts" in the Council on Environmental Quality (CEQ) regulations [40 CFR 1508.8]) includes ecological, aesthetic, historic, cultural, economic, social, and public health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions that have both beneficial and adverse effects, even if on balance the agency believes that the effect would be beneficial. An agency action may also have no impact on a particular resource or human use.

Alternative 1 No Action

The No Action Alternative provides a baseline against which environmental consequences of the NBNERR expansion alternative were compared. Under the No Action Alternative, the NBNERR management boundary would remain the same as delineated in the NBNERR Final EIS approved in August 1980, and the NBNERR Management Plan, 2010-2015. As described in Chapter 1, Section 315 of CZMA authorizes NOAA to designate different estuarine areas as estuarine reserves for inclusion in the NERRS for the purpose of long-term research, estuarine education, and environmental stewardship programs. The System also provides a framework through which management approaches, research results, and techniques for estuarine education and interpretation can be shared with other programs. Under the No Action Alternative, the integrated resource management framework of NERRS would not be extended in the proposed expansion area for NBNERR.

All NERRs in the System receive federal support through OCM. OCM plays four primary roles in the NERRS operations. First, it disburses and oversees expenditures of federal funds for research, education, land acquisition, operations, and development of individual reserves. Second, OCM coordinates and provides guidance in the development of policy for the Reserve system. Third, OCM promotes the System and undertakes certain projects that benefit the entire System. Finally, OCM participates in the periodic evaluation of Reserve operations to ensure compliance with federal requirements and with the individual Reserve's federally-approved management plan. Under the No Action Alternative, NOAA OCM would not extend its comprehensive natural resource protection to the expansion areas, which possess similar biogeographical and ecological characteristics as of the NBNERR. Federal funds through OCM/state cooperative agreement would not be used in the scientific research, environmental monitoring, environmental education and outreach, habitat restoration, and other natural resource management efforts of the expansion areas. The original biological, cultural, and economic need to protect the natural resources of Prudence, Patience, Hope, and Dyer Islands would continue. As explained above, the boundary expansion area would remain devoid of the multistep

environmental stewardship programs that are extended by the NOAA OCM, which might result in the ecological degradation of the proposed expansion area in the long term.

Alternative 2- Proposed Action

Under the proposed action, NOAA will approve the incorporation of the Little property (103 acres) into the existing management boundary of the NBNERR (15 C.F.R.§ 921.33). The Little property was acquired by RIDEM in 2015, with NOAA funding from the NERRS acquisition program, to protect it from development pressure. The Little property is located on Prudence Island, RI, the largest of the islands within the NBNERR, and situated in the geographic center of Narragansett Bay. The property runs primarily east-west from the western shore of Prudence Island across a high dry ridgeline, before it drops into the Mill Creek watershed and is bounded to the east by Sunset Hill Avenue. It is bounded along the northern border by another Reserve property as well as property owned by the Prudence Conservancy. The property is publicly accessible from both roads and trails for low impact recreational use such as birding, biking, hiking, and hunting. The boundary change will extend the comprehensive conservation and management capacities identified in the NOAA-approved NBNERR management plan to these new areas, providing a mechanism for implementation of specific restoration, monitoring and research activities for important marine resources. As described in Chapter 1, Section 315 of CZMA authorizes NOAA to designate different estuarine areas as estuarine reserves for inclusion in the NERRS for the purpose of long-term research, estuarine education, and environmental stewardship programs. The System also provides a framework through which management approaches, research results, and techniques for estuarine education and interpretation can be shared with other programs. Under the Action Alternative, the inclusion of the Little property will add an additional 103 acres to the NERR boundary.

All NERRs in the System receive federal support through OCM. OCM plays four primary roles in the NERRS operations. First, it disburses and oversees expenditures of federal funds for research, education, land acquisition, operations, and development of individual reserves. Second, OCM coordinates and provides guidance in the development of policy for the Reserve system. Third, OCM promotes the System and undertakes certain projects that benefit the entire System. Finally, OCM participates in the periodic evaluation of Reserve operations to ensure compliance with federal requirements and with the individual Reserve's federally-approved management plan. Under the Proposed Action Alternative, NOAA OCM will extend its comprehensive natural resource protection to the expansion areas (103-acre Little property), which possess similar biogeographical and ecological characteristics as of the existing NBNERR. Federal funds through OCM/state cooperative agreement would be used in the scientific research, environmental monitoring, environmental education and outreach, habitat restoration, and other natural resource management efforts of the expansion areas. The original biological, cultural, and economic need to protect the natural resources of Prudence, Patience, Hope, and Dyer Islands will also continue.

4.1 Physical Environment

4.1.1 Alternative 1 (No Action)

4.1.1.1 Air Quality

Under the No Action Alternative, the NBNERR boundary would not be expanded to include the Little Property. This alternative is not expected to have a significant impact on the air quality of the Narragansett Bay region because no net change in overall vessel traffic is anticipated, regardless of the alternative that is ultimately implemented. However, monitoring and research programs would be limited to within the current boundary, and therefore this alternative would prevent research and study of air quality of the additional property. Additionally, under this approach the Little Property would not enjoy the benefits of environmental stewardship programs in place to promote the environmental health of the current boundary.

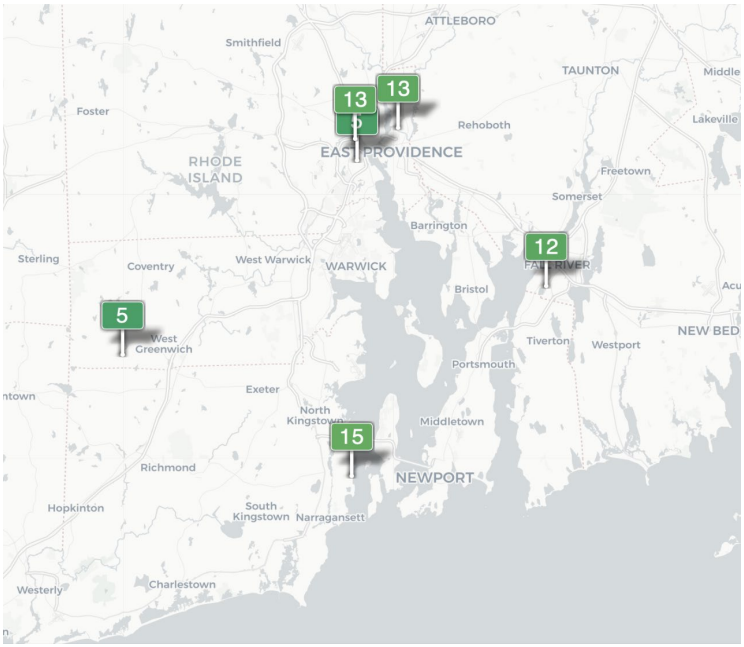

Figure 4. Air quality monitoring stations in NBNERR region

4.1.1.2 Greenhouse Gas Emissions and Effects of Climate Change

Climate change poses significant threats to the ecological health of Narragansett Bay and resilience of the region's natural habitats and native species. Many factors of climate change have affected Narragansett Bay. For example, in the last one hundred years, water temperatures in Narragansett Bay have increased by 3° F, bay waters have risen up to seven inches, and the rate of sea level rise has increased. Other consequences of climate change include beach erosion and loss of coastal access, shoreline property and infrastructure. Narragansett Bay has also experienced increased storm surge, including a rise in hurricane intensity and activity. These high rainfall events are often punctuated with periods of drought. When rainfall does come to

drought-stricken areas, the parched soils are less able to absorb the water, increasing the likelihood of flooding.[3]

Predicted climate change evaluations warn of the widespread effects that will impact Narragansett Bay. Higher temperatures will greatly affect the land and water of the NBNERR region. For example, it is anticipated that by 2050, Rhode Island will experience 40 days of extreme heat a year, which is four times the current average of 10 days. Changing weather patterns will increase the frequency, severity, and duration of harmful algal blooms, low oxygen levels, loss of native species, and increased presence of non-native species. Likewise, public and private infrastructure will be threatened due to extreme temperatures, coastal and riverine flooding, and storm surges. Additionally, rising sea levels will degrade the health of coastal wetlands and accelerate shoreline erosion, resulting in coastal habitat loss and an associated loss of public access along the shoreline.[4]

Under the No Action Alternative, there would be no change to the NBNERR boundary. The No Action Alternative is not expected to have a significant impact on the greenhouse gas emissions or climate change in the Narragansett Bay region, though emission monitoring and climate change research programs would be limited to within the current boundary. Therefore, this alternative would prevent analysis of greenhouse gas emission and climate change data in the NBNERR as an integrated unit, and would limit the reach of research and education. The exclusion of the Little Property might result in the ecological degradation of this expansion area in the long term as climate change increasingly affects the Reserve.

4.1.1.3 Water Resources and Quality

The Reserve has fully implemented the NERR system-wide monitoring plan (SWMP) for measuring water quality, nutrients, and meteorological data. The principal mission of this monitoring program is to develop quantitative measurements of short-term variability and long-term changes in the integrity and biodiversity of estuarine ecosystems for the purposes of contributing to effective coastal zone management. The SWMP is three-fold at NBNERR: (1) abiotic monitoring of estuarine parameters (e.g. water temperature, salinity, and dissolved oxygen; meteorological conditions; and estuarine nutrients); (2) biological monitoring; and (3) assessments and mapping of land use and habitat change over time.[5] In addition, Reserve staff members work with local communities and regional groups to address coastal resource management issues such as non-point source pollution.

Under the No Action Alternative, the Little Property would not be included in the NBNERR boundary and would not enjoy these positive impacts. Though the No Action Alternative is not expected to have a significant impact on water resources and quality in the Narragansett Bay region, water quality monitoring and research programs would be limited to within the current boundary. Therefore, this alternative would prevent research and study of the water quality of

[3] https://www.savebay.org/issues_old/climate-change/
[4] https://www.savebay.org/issues_old/climate-change/climate-change-statement/
[5] https://coast.noaa.gov/digitalcoast/data/nerr.html

NBNERR as an integrated unit. By extending monitoring efforts, physical resources in both the Reserve and the surrounding areas would indirectly benefit.

4.1.1.4 Geology and Substrates

The No Action Alternative is not expected to have a significant impact on the status of the geological features and soils of the Narragansett Bay reserve and adjacent region. However, potential for development does exist, which could cause disruption to those features. Any activities that could modify deposition and natural habitats in the expansion parcels would be discouraged under the NERR management but the reserve would not have the ability to enforce those protections. Additionally, the Reserve would not have access to the expanded area to perform research, monitoring, and habitat restoration. As climate change is expected to continue to cause negative effects on the island, the exclusion of the Little Property might result in ecological degradation without the reserve's ability to preserve the area through effective stewardship of the land.

4.1.1.5 Habitats

Adoption of the No Action Alternative increases the likelihood of habitat degradation on the Little Property, which could inadvertently affect habitat quality within the current NBNERR boundary long-term. For example, excluding the Little Property would likely increase invasive species spread to the current boundary, due to lack of species management within the excluded parcel. Additionally, excluding the Little Property from habitat management research would obstruct the assessment of habitats located in NBNERR as a single integrated unit. This may leave habitats located in the current boundary vulnerable to further anthropogenic degradation. Exclusion of the Little Property would also prevent that area from enjoying pollution protection and mitigation efforts, which may therefore affect the health of species and habitats located in NBNERR. However, no long-term adverse impacts are anticipated.

4.1.2 Alternative 2 (Preferred)

The Preferred Alternative -- expansion of the reserve boundary from 4,229 jurisdictional acres to a total of 4,332 acres -- would provide additional opportunities for research, monitoring, and education for the Reserve. Ownership of the parcel would remain unchanged. This expansion would allow for increased coordination and would provide a mechanism for integrated ecosystem management, which would help the Reserve achieve its mission of conserving natural biodiversity and cultural resources.

The Preferred Alternative has little to no potential to have a significant effect on the human environment. This action is administrative in nature and would have no adverse impacts on the physical environment. The acquisition would allow for increased and improved research and monitoring efforts, which will aid in the environmental protection of the NBNERR and the Narragansett Bay region as a whole. This action would also provide additional educational and outreach opportunities for the general public, thus providing a more positive experience to visitors of NBNERR.

4.1.2.1 Air Quality

As this is an administrative task, and no destructive activities are included in this action, no impact to air quality is anticipated. Acquisition of the Little property would allow Prudence Island to benefit from formal protection from further development, which would limit the potential for increased air pollution. Should any further, potentially disruptive activities be planned in the future, appropriate compliance consultations would be made at that time.

The expansion of the NERR boundary will presumably have indirect beneficial effects associated with expansion to include more protected land. With the inclusion of the Little Property, the NERR will not likely see any increase or decrease in land or aquatic vehicular traffic because no net change in overall vessel traffic is anticipated. Personally-owned vehicles can be brought to the NERR on the ferry, yet there are very few paved roads on which to operate the vehicles. As such, no overall impact on air quality due to vehicle exhaust is anticipated.

4.1.2.2 Greenhouse Gas Emissions and Effects of Climate Change

As discussed above, climate change is causing serious impacts to the Narragansett Bay region. The inclusion of the Little Property is not expected to increase greenhouse gas emissions or worsen climate change impacts, but instead will encourage environmental protection efforts throughout the Narragansett Bay region as a whole. Formal protection of the expansion parcel would allow for emission monitoring and climate change research programs within the NBNERR as a single integrated unit. Therefore, this alternative would permit analysis of greenhouse gas emission and climate change data in the region as a whole, and would expand the Reserve's ability to educate on the topics. Therefore, the Preferred Alternative will likely have positive effects on greenhouse gas emissions and effects of climate change long-term.

4.1.2.3 Water Resources and Quality

The inclusion of the Little Property has no potential to cause a significant impact on any physical resource. Under the Preferred Alternative, overall water quality of the NBNERR region would not be negatively affected. In fact, the inclusion of the Little Property within the NBNERR boundary will likely improve water quality in the Narragansett Bay region because environmental protection efforts would be expanded to the additional parcel. The current boundary enjoys pollution prevention and mitigation efforts, water quality research and monitoring, and outreach and education programs to promote cleaner water quality in the NBNERR area. The expansion of these measures would allow the Little Property to also benefit from such water resource protections, which would in turn promote healthier water in the entire NBNERR region.

4.1.2.4 Geology and Substrates

The Preferred Alternative is not expected to have a significant immediate impact on the status of the geological features and soils of the Narragansett Bay reserve and adjacent region. However, this action can ensure a limitation on future development, which could prevent disruption to those features long-term. The current boundary enjoys protection from activities that could modify the geological features and soils of the Reserve. Expansion of the NBNERR boundary to

include the Little Property will thus extend the Reserve's ability to enforce environmental protections. Additionally, the Preferred Alternative will allow the Reserve to access the expanded parcel to perform research, monitoring, and habitat restoration. The inclusion of this property in Reserve research efforts will allow for a better understanding of the natural environment of the NBNERR as a single unit and the management measures that would best benefit the Reserve. Lastly, climate change is expected to continue to cause negative effects on the Narragansett Bay region. The inclusion of the Little Property will allow for mitigation of those effects on the Little Property by extending the Reserve's ability to preserve the area through effective stewardship of the land. Should any further, potentially disruptive activities be planned in the future, appropriate compliance consultations will be made at that time.

4.1.2.5 Habitats

Expanding the NBNERR boundary to include the Little Property will extend the Reserve's efforts to maintain natural habitats. The Reserve employs various measures to promote the integrity of habitats found within the NBNERR. For example, invasive species management is crucial in protecting the habitat of native species. Expanding the boundary of NBNERR to include Little Property decreases the likelihood of invasive species growth because the expansion will allow for the implementation of species management measures throughout the NBNERR as an integrated unit.

By approving the expansion of the NERR, educational programs will also be extended through the Little Property, which will inform visitors to responsibly use the managed lands without causing permanent damage to habitats found in the NBNERR region. Thus, the Preferred Alternative has no potential to impact NBNERR habitats, but could potentially benefit these habitats in the long-term through increased environmental protection efforts.

Should any further, potentially disruptive activities be planned in the future, appropriate compliance consultations will be made at that time.

4.2 Biological Environment

4.2.1 Alternative 1 (No Action)

4.2.1.1 Invertebrates

Implementation of the No Action Alternative is not likely to cause a significant effect on invertebrate species in the NBNERR region. However, in the long-term, excluding the Little Property parcel from the NBNERR may cause minor effects on these species. As noted in Section 3, NBNERR research and monitoring efforts focusing on terrestrial invertebrates in the Reserve are plentiful. Including the Little Property in the data collection boundary will allow for more complete monitoring of invertebrate species within the Narragansett Bay region. Following the No Action Alternative will limit monitoring and research efforts of the Reserve, which will prevent incorporation of invertebrate data for NBNERR as an integrated unit. Over time, this may skew invertebrate data and prevent informed decisions regarding protection efforts for the species.

4.2.1.2 Fish

Implementation of the No Action Alternative is not likely to cause a significant effect on fish species in the NBNERR region. However, in the long-term, excluding the Little Property parcel from the NBNERR may cause minor affect to fish species. There are numerous fish species found within the Narragansett Bay. The No Action Alternative will exclude the Little Property from environmental stewardship actions executed by the Reserve. Additionally, expanding the boundary will allow for more complete monitoring of activities that might affect fish species within the Narragansett Bay region. The limitation of this parcel from the environmental monitoring and conservation efforts that the current boundary enjoys may harm fish species and EFH in the long-term. However, no long-term adverse impacts are anticipated.

4.2.1.3 Wildlife

As evidenced in Chapter 3, Narragansett Bay is home to a number of wildlife species. While wildlife species have their preferred habitats, they are mobile, and may be found in a variety of environments. The No Action Alternative will limit the Reserve's wildlife protection measures to the current boundary, leaving the Little Property vulnerable to environmental harm that impacts wildlife species found throughout Narragansett Bay region. Exclusion of the proposed parcel will also prevent the NBERR from being managed as a larger integrated unit, which may cause harm to species in the long-term. For example, data collection and analysis are critical for understanding changes occurring in the environment that affect wildlife species found throughout this region. Excluding the Little Property parcel from the Reserve's wildlife research may obstruct the assessment of wildlife located in the Narragansett Bay region. However, no long-term adverse impacts are anticipated.

4.2.1.4 Protected Species

NBNERR is the native habitat for many bird, marine and land mammal, fish, reptile, plant, and invertebrate species, among others. It is essential to understand how populations of rare and endangered species change over time in response to Reserve land management practices. Threatened or endangered species that are known to occur in the NBNERR area or boundary expansion area are listed in Table 3.2 (supra). When unmanaged, invasive species out-compete native species for resources, reducing native species diversity and resiliency. This can particularly affect endangered and threatened species. Additional information regarding species within the boundary can be found in Chapter 3 of this document. There are multiple non-native invasive species present throughout both palustrine and upland plant communities. Following the No Action Alternative would prevent efforts to maintain natural habitats and manage invasive species in the new parcel, which will result in the minor likelihood of an increase of invasive species spread to the current NBNERR area.

4.2.2 Alternative 2 (Preferred)

4.2.2.1 Invertebrates

Implementation of the Preferred Alternative is not likely to cause a significant effect on invertebrate species in the NBNERR region. Inclusion of the Little Property in the NBNERR

will extend the monitoring and research efforts of the Reserve and will allow for incorporation of invertebrate data for NBNERR as an integrated unit. Collecting invertebrate data in the NBNERR as a single integrated unit will allow for more complete monitoring of invertebrate species within the Narragansett Bay region. Following the Preferred Alternative will allow for extended monitoring and research efforts of the Reserve, which will include incorporation of invertebrate data for NBNERR as an integrated unit. Thus, any impact on invertebrates is likely to have long-term positive effects on the species.

4.2.2.2 Fish

The Preferred Alternative is not likely to cause a significant effect on fish species in the NBNERR region. There are numerous fish species, and EFH for multiple species, present within the Narragansett Bay. However, the proposed action is administrative in nature and will not have any effect on fish or EFH. Incorporating the Little Property in the NBNERR boundary will extend environmental stewardship measures to that parcel, which will promote environmental protection throughout Narragansett Bay. These actions will promote the environmental integrity of the region and thus prevent fish species and EFH from harm. Additionally, expanding the boundary will allow for more complete monitoring of activities that might affect fish species within the Narragansett Bay region. Including this parcel in the environmental monitoring and conservation efforts that the current boundary enjoys may benefit fish species and EFH in the long-term.

4.2.2.3 Wildlife

The Preferred Alternative is not anticipated to cause a significant effect to wildlife in the Narragansett Bay region. NBNERR and the proposed expansion area encompasses habitats for a wide assortment of wildlife species, including bird, marine and land mammal, fish, reptile, plant, and invertebrate species, among others. While these species have their preferred habitats, they are mobile, and may be found in a variety of environments. Including the Little Property in the NBNERR boundary will allow for more complete monitoring and conservation of wildlife species within the Narragansett Bay region. Additionally, habitat restoration and pollution prevention and mitigation measures that will extend to the Little Property will allow for further protection for wildlife species in the Narragansett Bay region as a whole.

4.2.2.4 Protected Species

The Preferred Alternative is not anticipated to cause a significant effect to protected species in the Narragansett Bay region. Many of the species found within the NBNERR region are designated by the USFWS and NMFS as either threatened or endangered. Threatened or endangered species that are known to occur in the NBNERR area or the boundary expansion area are listed in Table 3.2 (supra). As noted above, there are multiple non-native invasive species present throughout the NBNERR region that threaten protected species. When unmanaged, the invasive species out-compete native species for resources, reducing native species diversity and resiliency. With the expansion of the NERR to include the Little Property, the Reserve’s efforts to maintain natural habitats and manage invasive species will be extended to the new parcel.

4.3 Cultural and Historical Resources

4.3.1 Alternative 1 (No Action)

The No Action Alternative could limit the coordinated protection of any potential historical properties found within the proposed boundary expansion as a result of not being included in the management boundary.

4.3.2 Alternative 2 (Preferred)

The Preferred Alternative of including the Little Property in the NBNERR management area will provide the means to identify and protect historically and culturally significant sites and structures should they be discovered in the Little Property parcel. Incorporating the parcel will have no potential to affect historic and cultural properties protected under the NHPA. This action is managerial in nature, and does not involve any ground-moving activities that could disturb sites or their viewshed.

4.4 Socioeconomic Resources

4.4.1 Alternative 1 (No Action)

Existing socioeconomic activities at the reserve include educational programs, tourism, kayaking, hunting, fishing, boating, hiking, biking. The Little property, specifically, is commonly used for birding, biking, hiking, and hunting. As most of the recreational activities described utilize the natural setting of the reserve's islands, protecting more land through the acquisition of the Little Property would act to increase the amount of protected land available to tourists. The amount of agriculture is minimal and outside of the land to be added. No commercial activities occur on the land, as well. Previously, portions were logged and cleared and used for agriculture. Those activities have ceased and the parcel has since been allowed to return to its natural state under the ownership of the state of Rhode Island.

The expansion of the NBNERR is not expected to have an immediate impact on socioeconomic resources. The land is already being managed by the state of Rhode Island and is not currently being used for commercial or agricultural purposes. Agricultural resources associated with Prudence Island are minor and the industry is not expected to grow. However, it is possible that, without protection, the land could be developed leading to indirect effects on the watershed via runoff from urban development or agriculture. That possibility is not likely but portions of the Little property are suitable for farming. The No Action Alternative would prevent the expansion of monitoring, research, and education throughout the expansion area. Additionally, this alternative would limit tourism and recreational opportunities. Compared to the No Action Alternative, the Preferred Alternative is expected to have minor to moderate beneficial socioeconomic impacts.

4.4.2 Alternative 2 (Preferred)

With the Preferred Alternative, the Reserve will manage the expansion parcel for research and conservation. The reserve's partnerships and research oriented environmental stewardship would help in maximizing the land use and socioeconomic options in the area. Extending the Reserve's management and stewardship into the proposed expansion parcels will enhance opportunities for tourism and recreation (e.g., hiking, bird watching), yielding direct, long-term, localized benefits to marine area use, recreation, and socioeconomics. The addition of the new property would increase the connectivity of the reserve's lands allowing for better trail and road management allowing for recreational visitors to reach more of the island.

The community may realize a minor economic benefit from Reserve's research both inside and outside of the proposed expansion areas because of integrated habitat protection. For example, additional students, volunteers, and researchers would rent housing, purchase gasoline and groceries, etc. from regional merchants. The communities on Prudence Island are mainly white but no people live in the expansion area. The Reserve participates in and has developed educational programs that expose students and adults to the natural environment of the Reserve. These programs are available to people from all backgrounds. In addition, the Preferred Alternative proposes to incorporate a single expansion parcel into NBNERR administrative boundaries. As a result, the proposed action would be expected to have no adverse impact with respect to physically dividing an established community.

4.5 Cumulative Impacts

Potential cumulative effects are assessed to determine the incremental consequences of an action when added to other past, present, and reasonably foreseeable future actions (40 C.F.R 1508.7). The direct effects of an individual action may be negligible but could contribute to a measurable environmental impact when considered cumulatively with indirect effects and with other past and/or reasonably foreseeable future projects. Cumulative impacts may result from individually minor but collectively significant actions taking place over time.

4.5.1 Cumulative Impacts on the Physical Environment

The Preferred Alternative will have little to no potential to have a significant effect on the physical environment (air quality and climate, geology and substrates, and water), as this action is administrative in nature. However, the acquisition will allow for increased and improved monitoring, pollution mitigation, restoration efforts, climate change assessment, and outreach and education programs of the NBNERR as an integrated unit. Therefore, while the boundary expansion action itself has no potential to affect the physical environment, it will promote protection of the physical environment of the NBNERR and the Narragansett Bay as a whole in the long-term.

4.5.2 Cumulative Impacts on the Biological Environment

The Preferred Alternative is administrative in nature and has little to no potential to have a significant effect on the biological environment (living marine resources and protected species). However, in the long-term this action may benefit the biological environment in many ways. For example, the inclusion of the Little Property parcel in the NBNERR will allow for habitat

restoration and invasive species management efforts in the proposed parcel, which will positively affect wildlife species throughout the Narragansett Bay region. Additionally, inclusion of the Little Property in the NBNERR will extend the monitoring and research efforts of the Reserve which will allow for incorporation of wildlife data for NBNERR as an integrated unit. The administering of environmental stewardship actions in the extended parcel will promote the environmental integrity of the region and thus prevent further anthropogenic harm to the biological environment.

4.5.3 Cumulative Impacts on Cultural and Historical Resources

The expansion of the NBNERR is not expected to have an impact on any cultural or historic resources. The addition of the Little Property will allow for the further protection of historical resources on Prudence Island. Known historical sites in the expansion area include the Thomas Allin home site and the accepted site of Pulpit Rock. The expansion parcel also contains 16th-century stone walls, a gristmill, and a rifle pump. Currently, the Reserve protects and manages its existing cultural and historic resource sites, and will extend those efforts to the Little Property sites under the Preferred Alternative. Should any additional cultural or historic resources be discovered within the proposed boundary expansion area in the future, the comprehensive management approach afforded by NOAA would provide important protection and research capacities allowing for their appropriate conservation and documentation in accordance with the National Historic Preservation Act (NHPA). The Reserve designation of these additional areas would have no effect on the historic properties protected under NHPA. The No Action Alternative could limit the cohesive protection of any historical properties found within the Little Property as a result of not being included in the approved management boundary.

4.5.4 Cumulative Impacts on Socioeconomic Resources

The expansion of the NBNERR is not expected to have a significant impact on socioeconomic resources. However, it is possible that extending Reserve's management into the proposed expansion areas will advance opportunities for research, education, tourism, and recreation, which may result in long-term benefits to socioeconomic status of the Narragansett Bay area. Socioeconomic activities at the Reserve include educational programs, tourism, kayaking, hunting, fishing, boating, hiking, biking. The Little property is commonly used for birding, biking, hiking, and hunting. The expansion of the boundary will not restrict community participation in recreational activities and would provide additional opportunities to extend the educational programs already in place in the current NBNERR boundary. Increased visitation to the Reserve for recreation or tourism could result in increased visitor spending, thus causing a positive long-term impact on the Narragansett Bay local economy.

Chapter 5 Compliance with Other Laws

In addition to compliance with NEPA, OCM will comply with other environmental and administrative review requirements, including those listed below, as part of its consideration of the proposed action to change the Narragansett Bay NERR boundary. If OCM decides in the future to award funding to the NBNERR, OCM will conduct any additional environmental reviews required by law at that time.

Coastal Zone Management Act - Under the Coastal Zone Management Act (CZMA) (16 U.S.C. §§ 1451, *et seq.*) the federal agency must submit a Consistency Determination to the state if the federal agency determines the activity may have reasonably foreseeable effects on the state's coastal uses or resources. 15 C.F.R. § 930.34(a)(1). Federal agency activities must be consistent to the maximum extent practicable with the enforceable policies of the state's CMP. If there are no reasonably foreseeable effects, the federal agency may be required to provide a Negative Determination to the state. *See* 15 C.F.R. § 930.35.

Compliance: The federal agency activity is NOAA's approval of the boundary changes to the Reserve. NOAA has determined that the proposed action will not have any reasonably foreseeable effects on Rhode Island's coastal uses or resources and provided a negative determination to the RI CZMP. Whitten concurrence was received on October 14, 2021.

Endangered Species Act - Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. § 1536), requires that each Federal agency shall, in consultation with the with the National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS) (collectively, the Services) insure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat for those species. Consultation may be formal or informal. Informal consultation is appropriate when a federal agency's action "may affect but are not likely to adversely affect" listed species or critical habitats. The Services will concur with such a finding if the effects on listed species are expected to be discountable, or insignificant, or fully beneficial. Formal consultation with the Services and preparation of a biological assessment is required for actions that "may affect and are likely to adversely affect" listed species or critical habitats. The Services will prepare a biological opinion of the effects of the agency action, and will issue a permit authorizing the incidental take of listed species as long as the action is not likely to jeopardize the continued existence of a listed species. Incidental take statements for marine mammals may not be included in a take statement until regulations, authorizations, or permits under MMPA 101(a)(5) are completed.

Compliance*:* Chapter 3 lists the species and habitats identified by the Services as having the potential to occur within the proposed action, or sufficiently near the proposed action that potential activities there could affect such species. OCM concluded that the action may affect but would not likely adversely affect species listed as threatened or endangered. While no response was received at that time, during the public comment period, the USFWS confirmed that the action would benefit the saltmarsh sparrow, a species of special interest that is found in the nearby marsh. OCM has also determined that the expansion of the boundary would not affect NMFS-listed species as there are no NMFS-listed species on the Little property and no ground disturbing activities are proposed that could affect the marine environment.

Magnuson-Stevens Fishery Conservation and Management Act -The Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §§ 1801 et seq.), as amended and reauthorized by the Sustainable Fisheries Act (Public Law 104-297), established a program to promote the protection of Essential Fish Habitat (EFH) for Federally-managed species in the review of projects conducted under federal permits, licenses, or other authorities that affect or have the potential to affect such habitat. After EFH has been described and identified in fishery

management plans, Federal agencies are obligated to consult with NMFS with respect to all actions, or proposed actions, authorized, funded, or undertaken by the agency that may adversely affect EFH. An adverse effect is defined as any impact that reduces quality or quantity of EFH.

***Compliance*:** The proposed action will have no adverse effect on the Essential Fish Habitat in the area.

Marine Mammal Protection Act -The Marine Mammal Protection Act (MMPA) of 1972 (16 U.S.C. §§ 1361 et seq.), as amended, prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas, as well as the importation of marine mammals and marine mammal products into the U.S. There are some exceptions to the prohibitions on taking marine mammals, including a mechanism for requesting authorization from NMFS's Office of Protected Resources for "incidental," but not intentional, taking, of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing or directed research on marine mammals) within a specified geographic region. The MMPA and regulations adopted thereunder restrict harassment -- meaning any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal in the wild or that has the potential to disturb a marine mammal in the wild by causing disruption of behavioral patterns, including breathing, breeding, feeding, migration, and sheltering.

***Compliance*:** The proposed action will not cause the take of any marine mammals.

National Historic Preservation Act -The National Historic Preservation Act of 1966 (NHPA) (54 U.S.C. §§ 300101 *et seq.*) requires federal agencies to take into account the effects of their undertakings on historic properties in accordance with regulations issued by the Advisory Council on Historic Preservation (ACHP) at 36 C.F.R. part 800. The regulations require that federal agencies consult with states, tribes, and other interested parties (consulting parties) when making their effects determinations. The regulations establish four basic steps in the NHPA 106 process: determine if the undertaking is the type of activity that could affect historic properties, identify historic properties in the area of potential effects, assess potential adverse effects, and resolve adverse effects.

Compliance: OCM sent a letter to the Rhode Island Historical Preservation & Heritage Commission on October 24, 2019, inviting their participation in the undertaking. They did not respond. The action of expanding the reserve boundary to include the Little property will have no potential to affect historic and cultural properties protected under the NHPA. This action is managerial in nature and does not involve any ground-moving activities that could disturb sites or their viewshed.

Executive Order 12898- Environmental Justice -To be consistent with the President's Executive Order 12898 on Environmental Justice (February 11, 1994), Executive Order 12948 (Amendment to Executive Order 12898), and the Department of Commerce's Environmental Justice Strategy, applicants must ensure that their projects will have no disproportionately high and adverse human health or environmental effects on minority or low-income populations. Federal agencies must analyze the effects of proposed programs, policies, and activities on minority and low-income populations, including Indian Tribes.

***Compliance*:** The proposed action does not have a disproportionately high and adverse human health or environmental effects on minority or low-income populations.

Executive Order 13175 - Tribal Consultation – Executive Order 13175, "Consultation and Coordination with Indian Tribal Governments" requires federal agencies to engage in government-to-government consultation with federally-recognized tribes at the earliest practicable time it can reasonably anticipate that a proposed policy or initiative may have tribal implications. If a proposed action may have tribal implications, the office proposing the action should, at the earliest time practicable, review the NOAA 13175 Policy to determine whether tribal consultation should be initiated.

Compliance: There are no tribes residing on Prudence Island; however, OCM sent letters to the Mashpee Wampanoag Tribe, the Narragansett Tribe, the Wampanoag Tribe, inviting their participation and comment on the boundary expansion; no responses were received.

Chapter 6 Acknowledgements

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Chapter 7 References

15 C.F.R Part 921. National Estuarine Research Reserve System Regulations

16 U.S.C. § 1461. National Estuarine Research Reserve System (Section 315) (2005)

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Chapter 8 Appendices (via weblink)

Appendices A: Management plan

https://coast.noaa.gov/data/docs/nerrs/Reserves_NAR_MgmtPlan.pdf

Appendices B: Site profile Chapters 1-7

https://coast.noaa.gov/data/docs/nerrs/Reserves_NAR_SiteProfile.pdf

Appendices C: Site Profile Chapters 8-13

https://coast.noaa.gov/data/docs/nerrs/Reserves_NAR_SiteProfile.pdf